COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mathematics II [S1Lot2-SLiPL>Mat2]

Course

Field of study
Aviation

Year/Semester
2/3

Area of study (specialization)
Aircraft Engines and Airframes

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
20

Laboratory classes
0

Other
0

Tutorials
20

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Knowledge: The student has knowledge of mathematics at the secondary school level Skills: The student is able to solve problems and has the ability to use mathematical tools to solve tasks at the secondary school level - Social competences: The student understands the need for continuous improvement of competences (linguistic, professional and social) and knows the importance of higher mathematics methods in describing engineering and technical issues. He is able to independently search for information in the literature.

Course objective

The main goal is to understand the basic concepts and methods of the theory in order to apply them to solving engineering and technical problems.

Course-related learning outcomes

Knowledge:
1. has extended and deepened knowledge of mathematics including algebra, analysis, theory of differential equations, probability, analytical geometry as well as physics including the basics of classical mechanics, optics, electricity and magnetism, solid state physics, thermodynamics, useful for

formulating and solving complex technical tasks related to aviation engineering and modeling

Skills:
1. is able to obtain information from various sources, including literature and databases, both in Polish and English, integrate it properly, interpret and critically evaluate it, draw conclusions, and comprehensively justify the opinions he formulates
2. is able to properly use information and communication techniques, which are used at various stages of the implementation of aviation projects
3. is able to properly plan and perform experiments, including measurements and computer simulations, interpret the obtained results, and correctly draw conclusions from them
4. is able to formulate and solve tasks related to civil aviation, apply appropriately selected methods, including analytical, simulation or experimental methods
5. is able to solve tasks using air traffic problems and design a runway in accordance with applicable ICAO requirements
6. is able to solve tasks using basic knowledge of aerodynamics, flight mechanics and flow around bodies
7. is able to design means of transport with appropriate external requirements (e.g. regarding environmental protection)
8. the student is able to use theoretical probability distributions. The student is able to analyze and interpret statistical data. The student is able to use methods and tools of mathematical statistics in engineering practice
9. is able to prepare a short scientific paper, observing basic editorial principles. Is able to select appropriate methods for the research being conducted and is able to conduct a basic analysis of the results. 10. is able to organize, cooperate and work in a group, assuming different roles in it and is able to determine priorities appropriately for the implementation of a task specified by himself or others
11. is able to plan and implement the process of his own permanent learning and knows the possibilities of further education (second and third cycle studies, postgraduate studies, courses and exams conducted by universities, companies and professional organizations)

Social competences:
1. understands that in technology, knowledge and skills become outdated very quickly
2. is aware of the importance of knowledge in solving engineering problems and knows examples and understands the causes of malfunctioning engineering projects that led to serious financial and social losses or to serious loss of health or even life
3. is aware of the social role of a technical university graduate, in particular understands the need to formulate and communicate to the public, in an appropriate form, information and opinions on engineering activities, technological achievements, as well as the achievements and traditions of the engineering profession
4. correctly identifies and resolves dilemmas related to the performance of the profession of an aviation and astronautics engineer

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures: exam in the form of a credit for theory and tasks.
Classes: assessment of written tests in the semester and direct activity during classes. Obtaining 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 thoroughness of the work).

Programme content

1. Review of functions of one independent variable. Trigonometric and cyclometric functions. Trigonometric identities. Exponential and logarithmic equations and inequalities.
2. Complex numbers and their applications - definition and various forms (algebraic, trigonometric, exponential); geometric interpretation; operations in the set of complex numbers (Moivre's formula, complex root); polynomials (solving polynomial equations, fundamental theorem of algebra); sets in the complex plane.
3. Number sequences. The number e.
4. Limits of functions (at a point, left-hand side, right-hand side, improper, at infinity). Continuity of functions. Asymptotes.

5. Monotonicity and convexity of functions (using differential calculus). Study (course of variability) of functions.
6. Applications of derivatives (optimization tasks).
7. Indefinite integral - definition of indefinite integral and antiderivative, properties, basic formulas, integration by substitution and by parts, examples. Integrals of rational functions and selected integrals of irrational and trigonometric functions. Reduction formulas.
8. Definite integral - definition, geometric interpretation, Newton-Leibnitz formula, properties, basic formulas, integration by substitution and by parts. Examples and applications (area of a flat region, area of lateral surface and volume of a solid of revolution).
9. Matrix calculus - definition of matrices, their types and arithmetic; determinant of a square matrix and its properties (Laplace's theorem, Sarrus scheme, calculating the determinant by elementary operations using Laplace's expansion); inverse matrix and methods of finding it; rank of a matrix and its calculation.
10. Systems of linear equations (matrix notation, Cramer's theorem, Kronecker-Capelli theorem, matrix method of Gaussian elimination).
PART - 66 (THEORY -26.25 hours)
MODULE 1. MATHEMATICS
1.1. Arithmetic
Arithmetic terms and symbols, methods of multiplication and division, fractions and decimal fractions, coefficients and multiples, weight, measures and conversion factors, ratios and proportions, averages and percentages, areas and quantities, second powers, third powers, square and cubic roots. [2]
1.2. Algebra
a) Calculation of simple algebraic expressions, addition, subtraction, multiplication and division, use of parentheses, simple algebraic fractions; [2]
b) Linear equations and their solutions; Exponents and powers, negative and fractional powers; Binary system and other systems;
Equivalent equations and second degree equations with one unknown; [1]

Course topics

Topics:
1. Functions
2. Complex numbers
3. Number sequences. The number e.
4. Limits of functions
5. Derivative of a function of one independent variable. L’Hopital’s rule.
6. Monotonicity and convexity
7. Applications of the derivative (optimization tasks).
8. Indefinite integral
9. Definite integral
10. Matrix calculus
11. Systems of linear equations
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Teaching methods

1) Lectures:
- lecture conducted in an interactive manner with questions asked to a group of students or to specific students,
- partially using a multimedia presentation (e.g. examples, animations),

- theory presented in connection with the students' current knowledge,
- presentation of a new topic preceded by a reminder of related content known to students from school,
- taking into account various aspects of the presented issues,
- students' activity during classes is taken into account when giving the final grade.
2) Exercises:
- solving sample tasks on the board,
- initiating discussions on solutions,
- homework/additional tasks.

Bibliography

Basic:
1. M. Gewert, Z. Skoczylas, Analiza matematyczna 1, Oficyna Wydawnicza GiS, Wrocław 2005.
2. T. Jurlewicz, Z. Skoczylas, Algebra liniowa 1, Oficyna Wydawnicza GiS, Wrocław 2007.
3. I. Foltyńska, Z. Ratajczak, Z. Szafrański: Matematyka dla studentów uczelni technicznych, cz.1, cz.2,
Wydawnictwo Politechniki Poznańskiej, Poznań 2004.
4. J. Banaś, S. Wędrychowicz, Zbiór zadań z analizy matematycznej, Wydawnictwo WNT, Warszawa 1996.
5. W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach, cz.1, cz.2, Wydawnictwo naukowe PWN, Warszawa 2010.

Additional:
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Breakdown of average student's workload

	Hours	ECTS
Total workload	80	3,00
Classes requiring direct contact with the teacher	42	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	38	1,50