POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)
pl. M. Skłodowskiej-Curie 5, 60-965 Poznań

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Mathematics

Course

Field of study	Year/Semester
Chemical and process engineering	1/2
Area of study (specialization)	Profile of study
	general academic
Level of study	Course offered in
First-cycle studies	Polish
Form of study	Requirements
full-time	compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30		
Tutorials	Projects/seminars	
30		

Number of credit points

5

Lecturers

Responsible for the course/lecturer:

Dr Alina Gleska

Institute of Mathematics

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Responsible for the course/lecturer:

Dr Marian Dondajewski

Institute of Mathematics

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Prerequisites

Student has basic knowledge of elementary functions, algebraic operations, analytical geometry, trigonometry and mathematical analysis.

Students should be able to solve simple rational equations and inequalities, to give domains of elementary functions and to know their curves.

Students seriously treat the process of studying.

Course objective

The aim of subject is introduction to complex numbers and their some practical applications. Differential and integral calculus of one variable are presented together with their applications in mathematics and chemistry.

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Course-related learning outcomes

Knowledge

After completing the first degree studies, the graduate has expanded and in-depth knowledge of various branches of higher mathematics and detailed knowledge on the application of mathematical methods and tools in engineering and chemical sciences - K_W2

Skills

After completing the first degree studies, the graduate:

- can use knowledge of higher mathematics; can build and analyse simple mathematical models; can use mathematical tools and methods, including numerical ones, to solve engineering problems - K_U13

- is able to plan and implement self-education independently in order to raise and update their competences - K_U24

Social competences

After completing the first degree studies, the graduate:

- is aware of the deepening and expansion of knowledge to solve newly created technical problems - K_K1

- understands and appreciates the importance of intellectual honesty in own and other people's actions; is ready to demonstrate reliability, impartiality, professionalism and an ethical attitude - K_K1

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture - written exam during session

Tutorials - two long test + short tests (10 minutes) + activity

Assessment criteria:

below 50% - 2,0   50%-59% - 3,0   60%-69% - 3,5

70%-79% - 4,0   80%-89% - 4,5   90%-100% - 5,0

Programme content

1. Matrices. Arithmetic operations for matrices. Determinants of matrices (Laplace's expansions with respect to rows or columns). Properties of determinants. Inverse matrices.

2. Solutions of Cramer's systems of linear algebraic equations using determinants and inverse matrices.

3. Rank of matrices. Kronecker-Capelli theorem.

4. Gauss-Jordan elimination method of solving systems of linear algebraic equations (systems with one solution, with infinitely many solutions or without solutions). Inverse matrices obtained by Gauss-Jordan elimination procedure.

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5. Vectors in space R3. Operations on vectors (also using their coordinates) . Dot product of two vectors and the criterium of orthogonality of two vectors. Cross product and the criterium of parallelity of two vectors. Triple product. Applications of products for calculating areas of parallelograms and triangles, and volumes of tetrahedrons and parallelepipeds.

6. Equations of planes in space R3 (vector, scalar, linear and parametric equations). Equations of line in space R3 (vector, parametric and symmetric equations).

7. Angles between vectors. Angles between planes. Angles between lines and planes. Angle between two lines. Distances between: two points; a point and a plane; a point and a line.

8. Definition of the function of many variables. Geometric interpretation of function of two variables. Domain of functions. Partial derivatives of I and II order of function of two and three variables. Schwarz's theorem about mixed derivatives. Direct derivative of functions. Gradient of functions. Differentials of function – some applications.

9. Local extrema of functions of two and three variables. The smallest and the greatest values of functions on some regions.

10. Double integrals over rectangles. Iterated integrals.

11. Double integrals over regions normal with respect to: the axis OX, the axis OY. Change of variables in double integrals.

12. Geometric interpretation of double integrals.

13. Triple integrals over parallelepiped. Iterated integrals.

14. Triple integrals over normal regions. Change of variable in triple integrals.

15. Some applications of triple integrals.

16. Ordinary differential equations of I and II order: introduction. Solutions of ODE of I order with separated variables, homogeneous, linear nonhomogeneous (Lagrange's method and method of variation of parameters - undetermined coefficients), Bernoulli' equations and the exact equations. Solutions of ODE of II order which can be transformed to ODE of I order and equations of II order with constant coefficients.

Teaching methods

Lecture - multimedial presentation + examples on the blackboard

Tutorials - solving problems; discussion about obtained results

Bibliography

Basic

1. W. Żakowski, Matematyka, T.1 i T.2, WNT, Warszawa 2003.

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2. M. Gewert, Z. Skoczylas, Analiza matematyczna 1 (Definicje, twierdzenia, wzory), GiS, Wrocław 2011.

3. M. Gewert, Z. Skoczylas, Analiza matematyczna 1 (Przykłady i zadania), GiS, Wrocław 2011.

4. T. Jurlewicz, Z. Skoczylas, Algebra i geometria analityczna 1, (Definicje, twierdzenia, wzory), GiS, Wrocław 2007.

5. T. Jurlewicz, Z. Skoczylas, Algebra i geometria analityczna 1, (Przykłady i zadania), GiS, Wrocław 2007.

Additional

1. W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach, T.1, T.2, PWN, Warszawa 2011.

2. M. Grzesiak, Liczby zespolone i algebra liniowa, Wydawnictwo PP, Poznań 1999.

Breakdown of average student's workload

	Hours	ECTS
Total workload	130	5,0
Classes requiring direct contact with the teacher	70	3,0
Student's own work (literature studies, preparation for tutorials, preparation for tests and the final exam) [1]	60	2,0

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[1] delete or add other activities as appropriate