SYLLABUS OF A MODULE

Polish name of a module	**Elementy Matematyki Wyższej**
English name of a module	**Elements of Higher Mathematics**
ISCED classification - Code	0541
ISCED classification - Field of study	*Mathematics*
Languages of instruction	*English*
Level of qualification: ***1 – BSc (EQF 6)*** ***2 – MSc (EQF 7)*** ***3 – PhD (EQF 8)***	*1*
Number of ECTS credit points	*6*
Examination: ***EO – exam oral*** ***EW – exam written*** ***A - assignment***	*EW*
Available in semester: ***S – Spring only*** ***A – autumn only*** ***Y - both***	*A*

Number of hours per semester:

Lecture	Exercises	Laboratory	Seminar	E-learning	Project
30E	30				

MODULE DESCRIPTION

MODULE OBJECTIVES

O1. To introduce to the basics of linear algebra, to number sequence and number series theory, and differential calculus of one variable.

O2. To acquire the ability to perform operations on matrices and vectors, to solve the systems of linear equations, to analyse convergence of sequences and number and function series, and differential functions of one variable and to use basics of linear algebra and calculus.

PRELIMINARY REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge on linear algebra and calculus.
2. Knowledge on solving the elementary algebraic equations, operations on functions, calculations of easy limits of functions and sums of arithmetic and geometric sequences.

LEARNING OUTCOMES

LO 1 – Knowledge on the basics of linear algebra, properties of operations on vectors and matrices, properties of a determinant and a rank of matrix, systems of linear equations.

LO 2 – Knowledge on definitions and convergence tests of number series and sequences; Knowledge on the basic concepts, theorems, and applications of differential calculus of one variable.

LO 3 – Ability to perform operations on matrices and vectors, to calculate a determinant and a rank of a matrix, and an inverse of a matrix, to solve systems of linear equations with using Cramer theorem and the Gaussian elimination.

LO 4 - Ability to analyse convergence of number sequences and series; to calculate limits of functions and to find asymptotes; to calculate derivatives of first and higher orders of a function and apply them; to sketch the graphs of functions.

MODULE CONTENT

Type of classes – lecture	**Number of hours**
Lec 1, **Lec 2** Introduction to the mathematics course. Matrices and determinants – basic definitions, properties, theorems, basic operations with matrices, inverse matrix, rank of matrix, the matrix – vector equation, applications	**4**
Lec 3, Lec 4 The systems of linear equations – basic definitions, the Cramer rule, the Gaussian elimination.	**4**
Lec 5 – Lec 7 Revision of elementary functions: domain, graphs, properties. Number sequences – basic definitions and theorems, limits, Euler's number, indeterminate symbols. Number series.	**6**
Lec 8, Lec 9 Functions of one variable – limits of the function, limits at infinity, continuity, kinds of discontinuity.	**4**
Lec 10 – Lec 13 Differential calculus for the functions of one variable – derivatives, its interpretation and applications, asymptotes, monotonicity of function, local extreme points, convexity and concavity, points of inflection. Sketching graphs of functions.	**8**
Lec 14, Lec 15 - Taylor formula. Function series.	**4**
Sum	**30**
Type of classes– tutorial	**Number of hours**
T1, **T2** Making the students familiar with the course requirements. Operations with matrices, calculating determinants of any degree, inverse matrices, rank of matrix, solving matrix – vector equations.	**4**
T5, T6 Solving the system of linear equations using the Cramer rule and Gaussian elimination.	**4**
T7, T8 Revision of elementary functions: determining the domain of a function, study of the properties of functions, graphs. Testing monotonicity of number sequences, determining the limits of number sequences. Number series.	**6**
T9, T10 Computing limits, testing the continuity of a function, determining the kind of discontinuity.	**4**
T11 – T14 Finding the derivatives of the function, computing limits using the L'Hospital rule, determining the asymptotes, local extreme points, points of inflection, testing monotonicity, convexity and concavity of the function	**8**
T15 Achievement test.	**2**
Sum	**30**

TEACHING TOOLS

1. - lecture with using multimedia presentations
2. - exercises

WAYS OF ASSESSMENT (F – FORMATIVE, S – SUMMATIVE

F1. - assessment of preparation for exercises
F2. - assessment of the ability to apply the acquired knowledge while doing the exercises
F3. - evaluation of reports on the implementation of exercises covered by the curriculum
F4. - assessment of activity during classes
S1. - assessment of the ability to solve the problems posed and the manner of presentation obtained results - pass mark *
S2. - assessment of mastery of the teaching material being the subject of the lecture - exam

*) in order to receive a credit for the module, the student is obliged to attain a passing grade in achievement tests.

STUDENT'S WORKLOAD

L.p.	Forms of activity	Average number of hours required for realization of activity
1.	**Contact hours with teacher**	
1.1	Lectures	30
1.2	Tutorials	30
1.3	Laboratory	
1.4	Seminar	
1.5	Project	
1.6	Examination	3
	Total number of contact hours with teacher:	63
2.	**Student's individual work**	
2.1	Preparation for tutorials and tests	20
2.2	Preparation for laboratory exercises, writing reports on laboratories	
2.3	Preparation of project	
2.4	Preparation for final lecture assessment	20
2.5	Preparation for examination	15
2.6	Individual study of literature	20
	Total number of hours of student's individual work:	75
	Overall student's workload:	138
Overall number of ECTS credits for the module		6 ECTS
Number of ECTS points that student receives in classes requiring teacher's supervision:		2,6 ECTS
Number of **ECTS** credits acquired during practical classes including laboratory exercises and projects:		ECTS

BASIC AND SUPPLEMENTARY RESOURCE MATERIALS

1. Polyanin A. D., Manzhirov A. V., Handbook of Mathematics for Engineers and Scientists, Chapman & Hall/CRC, Taylor & Francis Group, 2007
2. Zill D. G., Wright W. S., Advanced Engineering Mathematics, Jones and Barlett Publisher, 5th Edition, 2012
2. Robinson D.J.S, A Course in Linear Algebra with Applications, World Scientific Publishing, 2006.
3. Ian Craw, Advanced Calculus and Analysis MA 1002, University of Aberden, 2000.
4. Trench William F., Introduction to Real Analysis, Pearson Education, 2003.
5. Bittinger Marvin L., Ellenbogen David J., Calculus and its Applications, Pearson International Edition, 2007.
6. M. Klimek, Z. Domański, J. Błaszczuk, Mathematics I, 2009– a handbook in an electronic version
7. Demidovich B., Problems in mathematical analysis, Mir Publishers Moscow, 1981
8. MIT OpenCourseWare, http://ocw.mit.edu

MODULE COORDINATOR (NAME, SURNAME, E-MAIL ADDRESS)

Dr inż. Anita Ciekot, Department of Mathematics, anita.ciekot@pcz.pl
Dr inż. Izabela Zamorska, Department of Mathematics, izabela.zamorska@pcz.pl