Course code A.2. **Course item** ……

1. INFORMATION ABOUT THE COURSE

A. Basic information

Course title	Advanced Mathematics
Field of study	Computer Aided Engineering
Cycle	*Second*
Study profile	*Academic*
Study mode	*Full-time*
Specialisation	*Not relevant*
Unit responsible for the field of study	*Faculty of Mechanical Engineering*
Lecturer	*Dr hab. Leszek Knopik, Prof. nadzw. UTP*
Introductory courses	*Elementary mathematics*
Prerequisites	*Knowledge of mathematical analysis, algebra, informatics*

B. Semester/ weekly timetable

Semester	Lectures	Classes	Laboratories	Project classes	Seminars	Field experience	ECTS credits
I	15	15	-	-	-	-	3

LEARNING OUTCOMES (acc. to National Qualifications Framework)

No.	Description of learning outcomes	Reference to learning outcomes for the field of study	Reference to learning outcomes for the area of study
KNOWLEDGE			
K1	Student knows and understands fundamental concepts and applications mathematics	CAE_W01	T2A-W02
K2	Student knows and understands the basic concepts in matrix algebra and its applications	CAE_W10	T2A-W01
K3	Student knows methods of linear equations solving and understands basic facts in matrix algebra	CAE_W10 CAE_W02	T2A-W01 T2A_W03 T2A_W07
SKILLS			
S1	Student is able to search information in scientific literature	CAE_U07	T2A-U01
S2	Student is able indicate the further direction of self-education	CAE_U10	T2A_U05
SOCIAL COMPETENCES			
SC1	Understands necessity of self-learning	CAE_K01	T2A_K01

2. TEACHING METHODS

multimedia lecture, discussion

2. METHODS OF EXAMINATION

colloquium, written report on chosen type of subjects at the end of the course

3. COURSE CONTENT

Specify the content separately for each type of classes in accordance with point I.B.	LECTURES. Matrix algebra, operations involving matrices, the transpose of matrix, the inverse matrix the rank of matrix, partitioned of matrices, triangular matrices, elementary transformations of matrices, determinants, computation of determinants. Solution system of linear equations by inversion of matrices Cramer's rules, Gaussian methods, methods of principal elements, method of iteration. Introduction to eingenvalues and eigenvector of matrix, expansion of determinants, finding the eigenvalues and eigenvectors of a positive definite matrix, finding the numerically largest eigenvalue of matrix and the corresponding eigenvector. Differential equations of the first order , homogenous equations of the first order and linear equations. Differential equations of the second order applications to mechanics. Introduction to system of differential equations, general definitions, normal form of a system differential equations. System of linear differential equations, mechanical interpretation of the solutions, matrix form of a system of linear equations. CLASSES Solutions simple exercise on matrix operations: transpose of matrix, multiplication of matrix, computations of determinants, inverse matrix and the rank of matrix. Solution of the system linear equations by inversion matrices and application Cramer's rules. Exercises on Gaussian method and iteration method. Example for Eingenvalues and eigenvector. Examples applications of differential equations of the first and second order. Mechanical applications of differential equations and system of differential equations.

4. VALIDATION OF LEARNING OUTCOMES

(Each learning outcome from the list requires validation methods to ensure that it was achieved by a student.)

Learning outcome	Form of assessment (for example:)					
	Oral examination	Written examination	Colloquium	Project	Report	……
K1			x		x	
K2			x		x	
K3			x		x	
S1			x		x	
S2			x		x	

S3			x		x	

5. LITERATURE

Basic literature	Gentle James, Matrix algebra theory, computations and applications to statistics Springer Text in Statistics, New York, 2007 Howard Anton, Elementary linear algebra, New York John Wiley 1981. Prasolov Victor, Problems and theorems in linear algebra American Mathematical Society, New York 1991.
Supplementary literature	Bellman Richard, Introduction to matrix analysis, McGraw-Hill, New York, 1960 Lankaster Peter, Theory of matrices, Academic Press, New York, 1969

6. TOTAL STUDENT WORKLOAD REQUIRED TO ACHIEVE EXPECTED LEARNING OUTCOMES EXPRESSED IN TIME AND ECTS CREDITS

Student's activity	Student workload– number of hours (for example:)
Participation in classes indicated in point 2.2	30
Preparation for classes	20
Reading assignments	15
Other (preparation for exams, tests, carrying out a project etc)	20
Total student workload	85
Number of ECTS credits allocated by the lecturer	**3**
Final number of **ECTS credits (determined by the Programme Council for the Field of Study)**	3