STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Optimization methods**		Code **1010341761010340552**
Field of study **Mathematics in Technology**	Profile of study (general academic, practical) **general academic**	Year /Semester **3 / 6**
Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **First-cycle studies** **(Polish Qualifications Framework level six)**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **30** Classes: **-** Laboratory: **30** Project/seminars: **-**		No. of credits **4**
Status of the course in the study program (Basic, major, other) **major**	(university-wide, from another field) **university-wide**	
Education areas and fields of science and art **Technical sciences** **Technical sciences**		ECTS distribution (number and %) **4 100%** **4 100%**

Responsible for subject / lecturer:

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Responsible for subject / lecturer:

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Knowledge of the course Introduction to Programming, Programming Methods, Discrete Mathematics, Mathematical analysis II, Numeric linear algebra. - [K_W01 (P6S_WG)], [K_W02 (P6S_WG)], [K_W06 (P6S_WG)]
2	**Skills**	Computer skills, including programming. The ability of effective self-education in the field related to the chosen field of study. - [K_U04 (P6S_UW)], [K_U09 (P6S_UW)], [K_U10 (P6S_UW)], [K_U12 (P6S_UK)], [K_U14 (P6S_UO)].
3	**Social competencies**	Knowledge of the limits of their knowledge and understanding of the need for further education. - [K_K01 (P6S_KK)], [K_K02 (P6S_KK)], [K_K03 (P6S_KO)].

Assumptions and objectives of the course:

Linear programming and quadratic programming. Both the general theory and characteristics of these optimization problems, as well as effective solution algorithms, are presented.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. He/She understands well the role and importance of proof in mathematics, as well as the concept and significance of assumptions. - [K_W01 (P6S_WG)]
2. He/She understands the structure of mathematical theories, can use mathematical formalism to build and analyze simple mathematical models describing phenomena from other scientific disciplines. - [K_W02 (P6S_WG)]
3. He/She knows the basic theorems from the known branches of mathematics; understands the civilizational significance of mathematics and its applications. - [K_W03 (P6S_WG)]
4. He/She knows at least one software package at the basic level, used for symbolic calculations. - [K_W06 (P6S_WG)]

Skills:

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1. Is able to comprehensively, in speech and in writing, present correct mathematical reasoning, formulate theorems and definitions, use the account of sentences and quantifiers; can correctly use quantifiers in colloquial language, can talk about issues concerning mathematics and the development of mathematics with an understandable, colloquial language. - [K_U01 (P6S_UW)]

2. Can provide easy and moderately difficult evidence by complete induction method; can define recursive functions and relations. - [K_U01 (P6S_UW)]

3. Uses the language of set theory, interpreting issues from various branches of mathematics, knows how to use the concept of real and complex numbers; knows examples of irrational and transcendental numbers. - [K_U01 (P6S_UW)]

4. Can define functions, including using border crossings, and describe their properties, uses in various contexts the concept of convergence and boundary; can - on the simple and medium level of difficulty - calculate the limits of sequences and functions, examine the absolute and conditional convergence of series. - [K_U01 (P6S_UW)]

5. Is able to interpret a system of ordinary differential equations in a geometric language, using the concept of vector field and phase space. - [K_U01 (P6S_UW)]

6. Identifies problems, including practical issues that can be solved algorithmically; is able to make a specification of such a problem, is able to compose and analyze an algorithm in accordance with the specification and save it in a chosen programming language, can compile, run a self-written computer program, can use computer programs in the field of data analysis. - [K_U04 (P6S_UW)]

7. Uses the concept of probabilistic space; can build and analyze a mathematical model of a random experiment, can give various examples of discrete and continuous probability distributions and discuss selected random experiments and mathematical models in which these distributions occur; knows the practical applications of basic distributions, knows how to use the formula for conditional probabilities, integer and Bayesian formula. - [K_U02 (P6S_UW)]

Social competencies:

1. Knows the limits of his own knowledge and understands the need for further education. - [K_K01 (P6S_KK)]

2. Is able to precisely formulate questions, to deepen one's own understanding of a given topic or find missing elements of reasoning, correctly resolves dilemmas related to the profession; can understandably convey information and opinions on the content of engineering and mathematical problems. - [K_K02 (P6S_KK), K_K05 (P6S_KR)]

3. He can think and act in an entrepreneurial way, he can work as a team; understands the need for systematic work on any projects that have a long-term nature. - [K_K03 (P6S_KO)]

Assessment methods of study outcomes

- evaluation of knowledge acquired in the lecture
- skills assessment related to the implementation of project tasks
- evaluation of student preparation for classes and laboratory evaluation of skills related to the implementation of laboratory exercises
- evaluation of reports
- evaluation of team skills

Course description

Date of revision: 31/10/2018

The Kuhn-Tucker Conditions and the Simplex Method
The Revised Simplex Method
Newton's Method for Systems of Nonlinear Equations
Interior-Point Methods
Solving Large Linear Programs
KKT Conditions for Quadratic Programming Problems
Linear Complementarity Problems
Approximation and Classification
Integer Linear Programming

Basic bibliography:

1. Dariusz Horla, Metody obliczeniowe optymalizacji w zadaniach – Wyd. 2 popr. i rozsz. – Poznań, 2016

Additional bibliography:

Result of average student's workload

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Activity	Time (working hours)
1. participation in lectures (15x2 hrs.)	30
2. participation in laboratory classes (15x2 hrs.)	30
3. completion (within own work) reports on laboratory exercises	5
4. write a program / programs, commissioning and verification (time outside of the classroom laboratory)	15
5. preparation for laboratory exercises	15
6. preparation for tests / test	5

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	100	4
Contact hours	60	2
Practical activities	30	1

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