STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
(-)		**1010401161010211150**
Field of study	Profile of study (general academic, practical)	Year /Semester
EDUCATION IN TECHNOLOGY AND	**(brak)**	**3 / 6**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**obligatory**
Cycle of study:	Form of study (full-time,part-time)	
First-cycle studies	**full-time**	
No. of hours		No. of credits
Lecture: **1** Classes: **-** Laboratory: **-** Project/seminars: **1**		**4**
Status of the course in the study program (Basic, major, other)	(university-wide, from another field)	
(brak)	**(brak)**	
Education areas and fields of science and art		ECTS distribution (number and %)
technical sciences		**4 100%**

Responsible for subject / lecturer:

Prof.dr hab. inż. Marian Ostwald
email: marian.ostwald@put.poznan.pl
tel. +48 61 6652176
Faculty of Mechanical Engineering and Management
Ul. Piotrowo 3, 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge of mathematics and others modules in the field of study. Structured theoretical knowledge of the field of study.
2	**Skills**	Ability of solving of mathematical problems in the field of study. Ability of searching for essential information from literature, data bases, internet and indicated sources. Ability of self-learning and self-education. Using information and communication technologies relevant to the tasks of engineering.
3	**Social competencies**	Understanding the need to learn and expand knowledge throughout their professional carrier. Understanding the rules of engineer?s activity, understanding the non-technical aspects of this activity and the responsibilities for the results. Readiness to take teamwork.

Assumptions and objectives of the course:

Presentation in a concise and approachable form the basis of optimum design of structures and other devices and systems. Highlighting the design process as an activity based on a systems approach (holistic), using a wide range of solutions based on the so-called lessons of nature. Presentation of the basic concepts of optimum design, introduction of the basic optimization procedures. Discussion of evolutionary programming and the basics of multi-criteria optimization. Presentation of modern optimization procedures using ?lesson of nature?. Acquiring the ability to find optimal solutions for simple technical systems in the laboratory.

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

Knowledge:

1. Having the necessary theoretical knowledge to optimize the structure to the level necessary for the field study. - [K_W18, K_W08]
2. Knowledge of the basic concepts and procedures necessary for the optimal design. - [K_W18]
3. Paying attention to the importance of optimization in the design process of technical devices, systems as well as in the area of professional and personal activities. - [K_W19]
4. Knowledge of the development trends of new procedures and methods of computation used in the practical design process. - [K_W17]
5. Understanding the systemic aspects of engineering activities, also in the area of optimal design. - [K_W19, K_W05]

Skills:

1. Ability to apply selected optimization procedures, the ability to apply optimization procedures contained in packages of mathematical programs. - [K_U01]
2. Finding the optimal solutions for simple technical systems. - [K_U04, K_U07, K_U08]
3. Understanding the importance of a systemic approach to the optimization problem. - [K_U13, K_U15, K_U25]
4. Ability to use methods found in nature to solving complex technical problems - [K_U01]

Social competencies:

1. Understanding the need for self-study related to development of technology. - [K_K03]
2. Appreciation and understanding the systemic and social impact of engineering. - [K_K06]
3. Understanding the importance of teamwork. - [K_K01]
4. Ability to make appropriate decisions and understanding the consequences of these decisions for environment - [K_K02, K_K06]

Assessment methods of study outcomes

Written exam.

Laboratory assessment ? project.

Course description

Introduction to design of engineering systems (multidisciplinary, mechatronic design) using engineering examples and and examples from lessons from nature. Basics of optimal design of mechanical structures. Importance and meaning of optimization in design. Basic optimization concepts and terms (objective function, design variables, constraints). Classification of optimization problems. Methods of scalar optimization without constraints and with constraints with penalty functions. Genetic algorithms as the example of applying the lessons from nature. Mathematic fundaments of multicriteria optimization. Introduction to the Pareto concept of optimality. Survey of the modern optimization procedures. Selection of the efficient optimization procedures for practical engineering problems.

Application during laboratory classes of selected optimization procedures (search minimum of function in the direction, solving of unconstrained and constraints optimization problems) using MATLAB Optimization Toolbox.

Basic bibliography:

1. Ostwald M.: Optymalizacja konstrukcji. Wydawnictwo Politechniki Poznańskiej, Poznań 2005.
2. Ostanin A.: Metody optymalizacji z MATLAB. Ćwiczenia laboratoryjne. Nakom Poznań.

Additional bibliography:

1. Eschenauer H., Koski J., Osyczka A., Multicriteria design optimization, procedures and applications. Springer-Verlag, Berlin 1990.
2. Kirsch U., Structural optimization - fundamentals and applications. Springer-Verlag, 1993.
3. Rao S. S., Engineering optimization - theory and practice. John Wiley and Sons, 1996.

Result of average student's workload

Activity	Time (working hours)
1. Participation in lecture.	15
2. Participation in laboratory.	15
3. Preparation for classes in the laboratory.	15
4. Preparation of the final project.	20
5. Consultations.	15
6. Preparation for the exam.	20

Student's workload

Source of workload	hours	ECTS
Total workload	100	4
Contact hours	45	2
Practical activities	55	2