STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Modelling of mechanical systems		**1010612221010640413**

Field of study	Profile of study (general academic, practical)	Year /Semester
Mechanical Engineering	**(brak)**	**1 / 2**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Heavy Machinery	**-**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
Second-cycle studies	**full-time**

No. of hours				No. of credits
Lecture: **1**	Classes: **2**	Laboratory: **-**	Project/seminars: **-**	**3**

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	**3 100%**
Technical sciences	**3 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge of mathematics, materials science, mechanics, basics of machine design, theory of machines and mechanisms and strength of materials acquired during the first and second degree studies.
2	**Skills**	Basics of vector and tensor analysis, the ability to solve differential equations, the ability to solve simple problems of mechanics and strength of the materials, the ability to conduct the engineering calculations and components selection, the ability to design machines and devices, the ability to make a technical documentation in accordance with the principles of engineering drawing, the ability of using CAD software.
3	**Social competencies**	Students are creative and consistent in the implementation of the tasks has autonomy to solve problems, acquire and improve their knowledge and skills..

Assumptions and objectives of the course:

The objective of the course is learning students a new mathematical apparatus necessary in the process of modeling materials and machines (mechanisms), learning the basics of physical and mathematical modeling of construction materials, machinery and equipment, some physical processes, learning the methods of optimization and computer simulations of construction and technological processes, with focus on the practical application of these skills in the design process of machines and devices.

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

Knowledge:

1. Has a basic knowledge of the mechanics of solids and discrete systems with many degrees of freedom and mathematical modelling of physical systems - [K2A_W02]
2. Has a basic knowledge of mathematical modeling of mechanical systems based on the principle of dynamics - [K2A_W02]
3. Has a basic knowledge of the application of modelling and constructional optimization in machine design - [K2A_W03]
4. Has a basic knowledge of building the simulation model with Finite Element Method (FEM) and analysis of the obtained results - [K2A_W05]

Skills:

1. Can use the assimilated knowledge of the mechanics of construction materials for the simulation of mechanical systems, mechanisms and machines - [K2A_U05]
2. Can model the mechanical system and determine its influence on the environment (e.g. vibrations) - [K2A_U14]
3. Can use the modelling and optimization of the construction in the design process of the machines - [K2A_U17]
4. Can perform the tests of the machines and devices on the basis of the computer simulations and use the obtained results in improving the construction of the machines - [K2A_U08, K2A_U12]

Social competencies:
1. Understands the need for lifelong learning; is able to inspire and organize the learning process of others - [K2A_K01]
2. Is aware of and understands the importance and impact of non-technical aspects of mechanical engineering activities and its impact on the environment, is aware of responsibility for decisions - [K2A_K02]
3. Is aware of the importance of professional and ethical behavior and respect different cultures - [K2A_K03]
4. Is aware of the responsibility of his/her own work and is ready to subdue to the principals of teamwork and take the responsibility of the task performed in cooperation - [K2A_K04]
5. Can versatile analyze and effectively realize assigned tasks - [K2A_K05]

Assessment methods of study outcomes
An exam from the lectures on the last lecture in semester, which evaluates the knowledge of the theory and the ability to use it in practice. Passing the classes based on the individual project of the machine or device with using modelling in the design process, which is submitted at the latest at the last classes. During the classes the current understanding of the previously presented material is verified by solving the tasks on the blackboard by students.

Course description
Notes on modeling - a goal of modeling entities. The modeling process - stages of modeling scheme. Physical modelling - simplifying assumptions, the physical parameters, examples of physical models. Mathematical modelling - basics model, the size of tensor, coordinate systems, principles for the formulation of constitutive relationships, formulate and solve the equations of motion of mechanical systems. Mathematical models of construction materials - one-parameter models, complex models, some models nonclassical. Mechanical systems one and two-parameter - equations of motion, vibration, undamped and damped. Mathematical models of selected processes - electromechanical systems, hydrodynamical systems. The analogies between the worlds of physical. Mathematical modelling of machines and devices ? forward and reverse kinematics (Denavit-Hartenberg notation), modelling stresses in the constructional elements, derivation of dynamic alternative parametres. Structure of the simulation models, Finite Elements Method (FEM). Optimization of construction.

Basic bibliography:

Additional bibliography:

Result of average student's workload

Activity	Time (working hours)
1. Participation in Lectures	15
2. Participation in Classes	30
3. Preparing to classes	5
4. Current application of the gained knowledge in the project	5
5. Making the project	10
6. Consultations	2
7. Preparing to pass lectures	4
8. Pass the exam	2
9. Pass the classes	2

Student's workload

Source of workload	hours	ECTS
Total workload	75	3
Contact hours	51	2
Practical activities	0	0