STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
FEM in Design Analysis		**1010252411010250208**

Field of study	Profile of study (general academic, practical)	Year /Semester
Mechatronics	**(brak)**	**1 / 1**
Elective path/specialty	**Subject offered in:**	**Course (compulsory, elective)**
-	**Polish**	**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: **-**	Laboratory: **1**	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%**
Technical sciences	**4 100%**

Responsible for subject / lecturer:

dr hab. Tomasz Stręk
email: tomasz.strek@put.poznan.pl
tel. 61 665 2339
Faculty of Mechanical Enginneering and Management
ul. Piotrowo 3, 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Knowledge of mathematics, mechanics, fluid mechanics, strength of materials, heat transfer and differential equations, numerical methods.
2	**Skills**	Logical thinking, the use of information obtained from the library and the Internet.
3	**Social competencies**	Understanding the need for learning and acquiring new knowledge

Assumptions and objectives of the course:

The student should obtain knowledge of theoretical and computational fundamentals for solution of basic linear and non-linear partial differential equation problems modeling and governing technical, engineering and nature problems. Theoretical and practical knowledge of computing using finite element method/analysis to solve the basic problems of linear and nonlinear scientific and technical issues described by partial differential equations (stationary and non-stationary problems).

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

Knowledge:

1. Knowledge of construction and receipt of the finite element - [K_W01]
2. Knowledge of the kinds and types of loads and restraint used when defining the boundary conditions. Knowledge of the types and properties of finite elements - [K_W15]
3. Knowledge of programs for engineering calculations in the field of computer simulation of physical systems - [K_W09]
4. He knows the modern methods of computer graphics engineering and theoretical basis for the calculation of engineering finite element - [K_W15]
5. Has a general knowledge of the methods of strength calculations and modeling of machine design in 3D systems - [K_W15]

Skills:

1. . Able to prepare studies and reports from the research and experimental simulation and discuss the results of their research, including technical documentation designed mechatronic devices in English. - [K_U03]
2. Able to design complex systems and mechatronics systems, applying the modeling and simulation - [-]

Social competencies:

1. Understand the need for lifelong learning; can inspire and organize the learning process of others - [K_K01]
2. Is aware of and understands the validity of the non-technical aspects and effects of engineering activities, including its impact on the environment and the associated responsibility for decisions. - [K_K02]
3. Able to interact and work in a group, taking different roles - [K_K03]
4. Able to think and act in a creative and enterprising - [K_K06]

Assessment methods of study outcomes

Rating forming and summarizing

Lecture: Examination under test consists of 5 questions of general scoring (credit for obtaining 51% of points:> 50% 3.0,> 60% 3.5,> 70%-4.0,> 80% 4.5,> 90 % 5.0) carried out at the end of the semester.

Computer Laboratory: Assessment based on the design developed problems related to the content of the three selected issues performed on laboratory exercises. To get credit laboratories all the exercises must be included.

Evaluated is the form and the quality of the prepared materials (description of issues, results and analysis).

Course description

Basis of finite element method. General partial differential equation. The COMSOL Multiphysics simulation software environment (modeling process ? defining your geometry, meshing, specifying your physics, solving, and then visualizing your results). Modeling, building and solving a conductive heat transfer problem using the General Heat Transfer application mode. Modeling, building and solving a structural mechanics problem (static analysis). Modeling, building and solving a structural mechanics problem (transient analysis). Modeling, building and solving a thermal-structural interaction problem (thermal expansion). Modeling, building and solving a fluid dynamics (static analysis). Modeling, building and solving a fluid dynamics (transient

Basic bibliography:

1. Zienkiewicz O.C. ,Taylor R.L., The Finite Element Method, Volume 1-3, Butterworth-Heinemann, Oxford, 2000
2. William B. J. Zimmerman, Multiphysics Modeling With Finite Element Methods, Series on Stability: Vibration and Control of Systems, Series A - Vol. 18, 2006.
3. Hutton, David V., Fundamentals of Finite Element Analysis, McGraw-Hill Science/Engineering/Math; 1 edition (June 25, 2003).
4. R. W. Lewis, Perumal Nithiarasu, Kankanhalli Seetharamu, Fundamentals of the Finite Element Method for Heat and Fluid Flow, Wiley, 2004
5. Guido Dhondt, The Finite Element Method for Three-dimensional Thermomechanical Applications, John Wiley & Sons Ltd, 2004

Additional bibliography:

1. Andriy Milenin, Podstawy metody elementów skończonych. Zagadnienia termomechaniczne. Wydawnictwo AGH, Kraków, 2010

Result of average student's workload

Activity	Time (working hours)
1. Lecture	15
2. Laboratory	15
3. Project	15
4. Consultations	10
5. Preparating to practice and project	30
6. Preparating to exam	15
7. Exam	2
8. Exam	2

Student's workload

Source of workload	hours	ECTS
Total workload	104	4
Contact hours	59	3
Practical activities	45	1