

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Computer Methods		Code 1010102111010110145
Field of study Civil Engineering Second-cycle Studies	Profile of study (general academic, practical) (brak)	Year /Semester 1 / 1
Elective path/specialty Bridges and Underground Engineering	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: Second-cycle studies	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) (brak)		(university-wide, from another field) (brak)
Education areas and fields of science and art technical sciences Technical sciences		ECTS distribution (number and %) 4 100% 4 100%
Responsible for subject / lecturer: prof. dr hab. inż. Tomasz Łodygowski email: tomasz.lodygowski@put.poznan.pl tel. +48 (61) 665 2450 Wydział Budownictwa i Inżynierii Środowiska ul. Piotrowo 5 60-965 Poznań		Responsible for subject / lecturer: prof. dr hab. inż. Tomasz Łodygowski email: tomasz.lodygowski@put.poznan.pl tel. +48 (61) 665 2450 Wydział Budownictwa i Inżynierii Środowiska ul. Piotrowo 5 60-965 Poznań
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	Mathematics: foundations of differential, integral and matrices calculus; Structural Mechanics, Strength of Materials and Theory of Elasticity on the level of 6 according to KRK system; Numerical Methods and Information Technology on the level of 6 according to KRK system;
2	Skills	The Student is able to follow through the static analysis of beam structures; Uses the displacement method for solving beam systems; The Student uses the selected software tools of computer analysis and design of structures;
3	Social competencies	Understand the role of continuous education in the direction of the study but also other technical sciences;
Assumptions and objectives of the course: To be familiar with the basics and applications of numerical methods and computational analysis of structures for linear and nonlinear cases; also to be responsible for proper modeling and the results of computations;		
Study outcomes and reference to the educational results for a field of study		
Knowledge:		
1. Advanced knowledge on the behavior and modeling of materials - [K_W01, K_W04] 2. Knows the foundations of numerical analysis for statics, dynamics and stability of structures - [K_W03] 3. Knows the tools and their constraints of numerical analysis of structures which support the computer aided design - [K_W08] 4. Has the basic knowledge on optimisation of structures - [K_W09]		
Skills:		
1. Is able to take the decisions on design of elements in civil engineering - [K_U03] 2. Can build the numerical models for 1-D, 2-D and 3-D cases and perform the static, dynamic and stability analyses - [K_U04] 3. Can define the computer model for complex engineering problems for linear cases and some nonlinear - [K_U06]		
Social competencies:		
1. Works independently and in the team - [K_K01] 2. Is responsible for the quality of results - [K_K02] 3. Understands the LLL necessity - [K_K03] 4. Works and lives according to the good ethic practices - [K_K11]		

Assessment methods of study outcomes		
<p>The lectures are finished with final egzam which consists of two parts - written test (1,5 hour) and if necessary oral one. In the written part the Students answer to 4-6 questions (problems). After reviewing the oral part is only for those who are the best in the group.</p> <p>During the labs the progres in the work of Students is evaluated. The marks are offered for every problem that has to be solved.</p>		
Course description		
<p>The course is focused on the following topics:</p> <ul style="list-style-type: none"> - Modeling in structural analysis (the real structure and its numerical model), matrix formulation of continuum mechanics; - Finite Element Method (FEM), approximation of displacement field; shape functions; stiffness matrices for selected elements in local coordinate systems; - Transformation and the basic steps of FEM computations for linear cases; - The field of applications of FEM in civil and mechanical engineering; - Natural coordinate system, Isoparametric elements, numerical integration, selected FE for 2-D and 3-D problems, plates and shell elements; - selected problems in dynamics and stability; - Elements of optimal design of structures 		
Basic bibliography:		
<ol style="list-style-type: none"> 1. T.Łodygowski, W.Kąkol, Metoda elementów skończonych w wybranych zagadnieniach mechaniki konstrukcji inżynierskich (in Polish), on teh web page of The CAD Chair 2. G.Rakowski, Z. Kacprzyk, Metoda elementów skończonych w mechanice konstrukcji (in Polish), Oficyna Wydawnicza Politechniki Warszawskiej 3. M.Kleiber i in., Zastosowanie metod komputerowych w mechanice kontinuum (in Polish), PWN Warszawa, 1996 4. O.C.Zienkiewicz, (R.Taylor), The finite element method, Ed. 1 - 6, 1972 - 2007 5. T.J.R.Hughes, The finite element method. Linear static and dynamics, Prentice-Hall Eds., 1987 6. Web page: www.cad.put.poznan.pl 		
Additional bibliography:		
Result of average student's workload		
Activity	Time (working hours)	
1. Participation in lectures	30	
2. Participation and the work during the labs	30	
3. Preparing of the excersises - partialy at home	30	
4. Preparing for the exam	30	
5. Consulting hours	10	
Student's workload		
Source of workload	hours	ECTS
Total workload	100	4
Contact hours	70	3
Practical activities	60	2