

<b>STUDY MODULE DESCRIPTION FORM</b>		
Name of the module/subject <b>Computational Mechanics</b>		Code <b>1010112111010113703</b>
Field of study <b>Civil Engineering</b>	Profile of study (general academic, practical) <b>general academic</b>	Year /Semester <b>1 / 1</b>
Elective path/specialty <b>-</b>	Subject offered in: <b>Polish</b>	Course (compulsory, elective) <b>obligatory</b>
Cycle of study: <b>Second-cycle studies</b>	Form of study (full-time, part-time) <b>full-time</b>	
No. of hours Lecture: <b>30</b> Classes: <b>-</b> Laboratory: <b>-</b> Project/seminars: <b>30</b>		No. of credits <b>4</b>
Status of the course in the study program (Basic, major, other) <b>major</b>		(university-wide, from another field) <b>from field</b>
Education areas and fields of science and art <b>technical sciences</b> <b>Technical sciences</b>		ECTS distribution (number and %) <b>4 100%</b> <b>4 100%</b>
<b>Responsible for subject / lecturer:</b> 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		<b>Responsible for subject / lecturer:</b> 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
<b>Prerequisites in terms of knowledge, skills and social competencies:</b>		
1	<b>Knowledge</b>	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	<b>Skills</b>	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	<b>Social competencies</b>	Understand the role of continuous education in the direction of the study but also other technical sciences;
<b>Assumptions and objectives of the course:</b> 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;		
<b>Study outcomes and reference to the educational results for a field of study</b>		
<b>Knowledge:</b>		
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]		
<b>Skills:</b>		
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]		
<b>Social competencies:</b>		
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]		

<b>Assessment methods of study outcomes</b>		
<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>		
<b>Course description</b>		
<p>The course is focused on the following topics:</p> <ul style="list-style-type: none"> <li>- Modeling in structural analysis (the real structure and its numerical model), matrix formulation of continuum mechanics;</li> <li>- Finite Element Method (FEM), approximation of displacement field; shape functions; stiffness matrices for selected elements in local coordinate systems;</li> <li>- Transformation and the basic steps of FEM computations for linear cases;</li> <li>- The field of applications of FEM in civil and mechanical engineering;</li> <li>- Natural coordinate system, Isoparametric elements, numerical integration, selected FE for 2-D and 3-D problems, plates and shell elements;</li> <li>- selected problems in dynamics and stability;</li> <li>- Elements of optimal design of structures</li> </ul>		
<b>Basic bibliography:</b>		
<ol style="list-style-type: none"> <li>1. T.Łodygowski, W.Kąkol, Metoda elementów skończonych w wybranych zagadnieniach mechaniki konstrukcji inżynierskich (in Polish), on teh web page of The CAD Chair</li> <li>2. G.Rakowski, Z. Kacprzyk, Metoda elementów skończonych w mechanice konstrukcji (in Polish), Oficyna Wydawnicza Politechniki Warszawskiej</li> <li>3. M.Kleiber i in., Zastosowanie metod komputerowych w mechanice kontinuum (in Polish), PWN Warszawa, 1996</li> <li>4. O.C.Zienkiewicz, (R.Taylor), The finite element method, Ed. 1 - 6, 1972 - 2007</li> <li>5. T.J.R.Hughes, The finite element method. Linear static and dynamics, Prentice-Hall Eds., 1987</li> <li>6. Web page: <a href="http://www.cad.put.poznan.pl">www.cad.put.poznan.pl</a></li> </ol>		
<b>Additional bibliography:</b>		
<b>Result of average student's workload</b>		
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	
<b>Student's workload</b>		
Source of workload	hours	ECTS
Total workload	125	4
Contact hours	65	3
Practical activities	65	2