

# SYLLABUS

## Course description

Course code		Course	SPRZĘŻONE ANALIZY TERMICZNO-MECHANICZNO-PRZEPŁYWOWE		
MB/O/I/ST/C1A.16			NUMERICAL MODELING OF FLUID - STRUCTURE INTERACTION		
Language of instruction		English			
Academic year		2023/2024			
field of study:		Mechanics and machine construction			
field of specialisation:		CAE			
Educational level		first-cycle studies			
Education profile		general academic			
Mode of study		full-time studies			
Semester(s)		7			
Affiliation with a group of classes		Specialization module			
Course status		obligatory			
Types of classes, instruction hours, ECTS credits		Types of classes	Number of instruction hours	Number of ECTS credits	
		Lecture	15[h]	3 ECTS	
		Project	30[h]		
Linkage of the course	with the education profile	related to the conducted scientific activity in the discipline to which the field of study is assigned (general academic profile)			3 ECTS
	with qualifications	serves the student to acquire engineering competences			3 ECTS
	with science discipline	Mechanical Engineering			3 ECTS
Form of teaching		Traditional – classes organized at the University /classes conducted using online learning methods and techniques			
Prerequisites		-			
Department		Faculty of Mechanical Engineering, UTH Radom			
Coordinator		Przemysław Motyl, PhD			
The website of the basic organizational unit		www.wm.uniwersytetradom.pl			
E-mail address, phone number of the coordinator		p.motyl@uthrad.pl			

# LEARNING OUTCOMES, CURRICULUM CONTENT, TEACHING CLASSES, VERIFICATION OF LEARNING OUTCOMES

Learning Objective:	<p>The aim of the course covers essential elements of dynamics of elastic bodies, basic fluid mechanics, and their interaction.</p> <p>The course strives to offer a balanced coverage of theoretical aspects and modern computational methods for modeling, analysis and design of fluid-structure interaction systems.</p>
Curriculum Content:	Theoretical basics: dimensional analysis of fluid-solid coupling, a solid with a still fluid, a solid with any fluid, coupling with a fast flow, coupling with a slow flow. Hands-on examples one and two-way coupling with validation.
Didactic (educational) methods:	<p>feeding methods (information lecture, lecture, reading),</p> <p>problem methods (problem lecture, conversational lecture),</p> <p>activating methods (case method, situational method, didactic games, seminar, didactic discussion),</p> <p>exposing methods (film, exhibition, show),</p> <p>programmed methods (with the use of a computer),</p> <p>practical methods,</p>
Course assessment type, the criteria for assessing the achieved learning outcomes, and the method of calculating the final grade:	The condition for passing a subject is to achieve all the required learning outcomes specified for a given subject. Obtaining positive grades in all forms of classes included in the course is tantamount to passing it and gaining by the student the number of ECTS points assigned to the subject. The final grade is the average of grades from all forms of classes included in the course.

Learning outcomes for the course in relation to the field of study learning outcomes and the type of classes				Methods of verifying learning outcomes	
Learning outcome number	Description of the learning outcomes for the course (PEU) A student who has passed the course ( <b>W</b> ) knows and understands / ( <b>U</b> ) can / ( <b>K</b> ) is ready to:	Field of study learning outcome (KEU)	Types of classes	Form of verification (credits)	Methods of testing and assessment
W1	The student knows the basic methods of numerical modeling of solid-fluid coupled issues.	K_WG01 K_WG16 K_WG17	Lecture / Project exercises	Assessment test	Colloquium
W	The student is able to choose appropriate models, available in computational packages in order to implement engineering activities – FSI computer simulations.	K_UW05 K_UW13	Project exercises	Assessment test	Assessment based on the completed task
U1	The student knows how to work in a team.	K_KK02	Project exercises	Verbal assessment	-

Literature and teaching aids
<p>Basic and supplementary literature</p> <ol style="list-style-type: none"> <li>1. Jean-François Sigrist, Fluid-Structure Interaction: An Introduction to Finite Element Coupling, ISBN:9781119952275, DOI:10.1002/9781118927762, Copyright © 2015 John Wiley &amp; Sons, Ltd</li> <li>2. John D. Anderson Jr., Computational Fluid Dynamics, McGraw-Hill Higher Education , ISBN-13: 978-0070016859</li> <li>3. Joel H. Ferziger, Milovan Peric, Computational Methods for Fluid Dynamics, Springer Berlin Heidelberg, ISBN-10: 3540420746</li> <li>4. Kosma Z.: Metody numeryczne dla zastosowań inżynierskich, WPRad, 2007.</li> <li>5. Gryboś R.: Podstawy mechaniki płynów, Wyd. Naukowe PWN, Warszawa 1998.</li> <li>6. Documentation for Fluent programs from Ansys, OpenFOAM, Autodesk CFD.</li> <li>7. Instructions prepared by the instructors.</li> </ol>

Student workload required to achieve the assumed learning outcomes – the balance of ECTS credits			
Attendance, participation	Student workload [h].		
	Other contact hours (IGK)	Student's self-study hours Classes without a teacher (ZBN)	Classes
Participation in ... lectures	X	X	15 [h]
Participation in .... classes/laboratory classes	X	X	30[h]
Meeting with teachers during their duty hours	2 [h]	X	X
Preparation for lectures/classes/.... , Preparation for ... credit / exam	X	10 [h] / 10 [h] 8 [h]	X
Total student workload	2 [h]/ 0,1 ECTS	28 [h]/1,1 ECTS	45[h]/ 1,8 ECTS
ECTS credits for the course	75 h/ 3 ECTS		

Additional information, comments
<p>In the case of students with special needs, including disabilities, and chronic illnesses, the methods and forms of verification of learning outcomes specified above (in the syllabus) are adapted to the individual needs of these students, as appropriate.</p> <p>Detailed rules and forms of support for students with special needs, including those with disabilities and chronically ill, during classes, credits, and exams are specified in: University Regulations (Regulamin Studiów Uniwersytetu Technologiczno-Humanistycznego w Radomiu), Study Regulations (Zasady Studiowania), and Procedure for Ensuring Accessibility of the Educational Process to Students with Special Needs, Including Those with Disabilities and Chronically ill (Procedura dotycząca zapewnienia dostępności procesu kształcenia studentom ze szczególnymi potrzebami, w tym: z niepełnosprawnością, przewlekłe chorych).</p>

