SYLLABUS

Course description

<table>
<tr><td colspan="2">Course code</td><td rowspan="2">Course</td><td colspan="3">NUMERYCZNE MODELOWANIE PROBLEMÓW CIEPLNO-PRZEPŁYWOWYCH</td></tr>
<tr><td colspan="2">MB/O/I/ST/C1A.11</td><td colspan="3">NUMERICAL MODELING OF HEAT-FLOW PROCESSES</td></tr>
<tr><td colspan="2">Language of instruction</td><td colspan="4">English</td></tr>
<tr><td colspan="2">Academic year</td><td colspan="4">2023/2024</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="2">field of study:</td><td colspan="4">Mechanical engineering</td></tr>
<tr><td colspan="2">field of specialisation:</td><td colspan="4">CAE</td></tr>
<tr><td colspan="2">Educational level</td><td colspan="4">first-cycle studies</td></tr>
<tr><td colspan="2">Education profile</td><td colspan="4">general academic</td></tr>
<tr><td colspan="2">Mode of study</td><td colspan="4">full-time studies</td></tr>
<tr><td colspan="2">Semester(s)</td><td colspan="4">6</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="2">Affiliation with a group of classes</td><td colspan="4">Specialization module</td></tr>
<tr><td colspan="2">Course status</td><td colspan="4">obligatory</td></tr>
<tr><td colspan="2" rowspan="3">Types of classes, instruction hours, ECTS credits</td><td>Types of classes</td><td>Number of instruction hours</td><td colspan="2">Number of ECTS credits</td></tr>
<tr><td>Lecture</td><td>15[h]</td><td colspan="2" rowspan="2">3 ECTS</td></tr>
<tr><td>Laboratory</td><td>30[h]</td></tr>
<tr><td rowspan="3">Linkage of the course</td><td>with the education profile</td><td colspan="3">related to the conducted scientific activity in the discipline to which the field of study is assigned (general academic profile)</td><td>3 ECTS</td></tr>
<tr><td>with qualifications</td><td colspan="3">serves the student to acquire engineering competences</td><td>3 ECTS</td></tr>
<tr><td>with science discipline</td><td colspan="3">Mechanical Engineering</td><td>3 ECTS</td></tr>
<tr><td colspan="2">Form of teaching</td><td colspan="4">Traditional – classes organized at the University /classes conducted using online learning methods and techniques</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="4">-</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="2">Department</td><td colspan="4">Faculty of Mechanical Engineering, UTH Radom</td></tr>
<tr><td colspan="2">Coordinator</td><td colspan="4">Przemysław Motyl, PhD</td></tr>
<tr><td colspan="2">The website of the basic organizational unit</td><td colspan="4">www.wm.uniwersytetradom.pl</td></tr>
<tr><td colspan="2">E-mail address, phone number of the coordinator</td><td colspan="4">p.motyl@uthrad.pl</td></tr>
</table>

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

Learning Objective:	The aim of the course is to acquire knowledge and skills regarding knowledge of basic computational methods of fluid mechanics.
Curriculum Content:	The content of the classes is related to the conducted scientific research. Lecture: Equations for conservation of mass, momentum and energy. Laminar and turbulent flows. Modeling turbulent flows. Methods of discretization of fluid mechanics equations. Solving Navier-Stokes equations for incompressible flows. Convergence and stability of numerical solutions. Parallel calculations. Generate computational grids. Software packages: OpenFOAM, ANSYS, Autodesk CFD. Evaluation of the obtained results of numerical calculations. Laboratory: Writing standalone applications in C++ on the topics discussed in lectures. Performing design tasks using packages: Fluent from Ansys, OpenFOAM, Autodesk CFD.
Didactic (educational) methods:	feeding methods (information lecture, lecture, reading), problem methods (problem lecture, conversational lecture), activating methods (case method, situational method, didactic games, seminar, didactic discussion), exposing methods (film, exhibition, show), programmed methods (with the use of a computer), practical methods,
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 (**W**) knows and understands / (**U**) can / (**K**) 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 determination of the motion of viscous liquid.	K_WG01 K_WG11 K_WG16 K_WG17	Lecture / Laboratory exercises	Assessment test	Colloquium
U1	The student is able to choose appropriate models, available in commercial computational packages in order to implement engineering activities – computer simulations in fluid mechanics. The student can write his own computer programs to implement simple numerical calculations in the field of fluid mechanics.	K_UW02 K_UW05 K-UW13	Laboratory exercises	Assessment test	Assessment based on the completed task
K1	The student knows how to work in a team.	K_KK02	Laboratory exercises	Verbal assessment	-

Literature and teaching aids
Basic and supplementary literature John D. Anderson Jr., Computational Fluid Dynamics, McGraw-Hill Higher Education , ISBN-13: 978-0070016859 Joel H. Ferziger, Milovan Peric, Computational Methods for Fluid Dynamics, Springer Berlin Heidelberg, ISBN-10: 3540420746

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
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. 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, przewlekle chorych).