

SYLLABUS

Course description

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|---|----------------------------|---|------------------------------|------------------------|--------|
| Course code | | Course | Optymalizacja konstrukcji | | |
| ME/O/I/ST/C8a | | | Optimization of construction | | |
| Language of instruction | | English | | | |
| Academic year | | 2025/2026 | | | |
| field of study: | | Mechanical Engineering | | | |
| field of specialisation: | | All | | | |
| Educational level | | first-cycle studies | | | |
| Education profile | | General academic | | | |
| Mode of study | | Part-time studies | | | |
| Semester(s) | | 7 | | | |
| Affiliation with a group of classes | | C. Group of courses to choose from | | | |
| Course status | | Electable | | | |
| Types of classes, instruction hours, ECTS credits | | Types of classes | Number of instruction hours | Number of ECTS credits | |
| | | Lecture | 8 [h] | 4 ECTS | |
| | | Classes | -- [h] | | |
| | | Lab | 15 [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 | | | 4 ECTS |
| | with qualifications | It is used to acquire engineering competences by the student | | | 4 ECTS |
| | with science discipline | Mechanical engineering | | | 4 ECTS |
| Form of teaching | | Traditional – classes organized at the University /classes conducted using distance learning methods and techniques | | | |
| Prerequisites | | knowledge of mechanics (statics) and mathematics | | | |
| Department | | Faculty of Mechanical Engineering | | | |
| Coordinator | | dr inż. Marcin Wikło, prof. URad | | | |
| The website of the basic organizational unit | | http://wm.uniwersytetradom.pl | | | |
| E-mail address, phone number of the coordinator | | m.wiklo@urad.edu.pl | | | |

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

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|---------------------|---|
| Learning Objective: | C1 – To acquaint students with issues related to optimization and types of optimization |
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| | <p>C2 – Mastering the skills associated with defining the optimization task</p> <p>C3 – The use of software designed to optimize the structure</p> |
| Curriculum Content: | <p>Content of lectures</p> <p>Introduction to optimal design. Specifying the types of optimization. Presentation of mathematical foundations in structural optimization. Examples of the use of optimization in issues not related to the optimization of the structure. Presentation of the method of optimal construction design using strength criteria. Definition of optimization task: objective function, limitations. Solving optimization tasks in numerical calculation software..</p> <p>The content of laboratory exercises</p> <p>The use of software for numerical calculations in optimization. A stand-alone solution for a single and multidimensional project.</p> <p>Designing a structure/frame that meets the limitations imposed during the classes, manual optimization of the designed structure, optimization with using the software to find the optimal geometry, a summary of results.</p> <p>Topological optimization, a definition of optimization areas and areas separated from optimization. Definition of new geometry after topological optimization. With use of the dedicated software. Manufacturability on an example of the geometry from the topological optimization.</p> |
| Didactic (educational) methods: | Informative lecture and calculation exercises |
| Course assessment type, the criteria for assessing the achieved learning outcomes, and the method of calculating the final grade: | <p>The condition for passing the course is to achieve all the required learning out comes specified for the course.</p> <p>The average obtained by the student's grades from the in class test - lecture and from the projects - exercise</p> |

| 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 | A student has knowledge including the ability to model machine construction, conduct numerical simulations and use numerical simulation software | K_WG01, K_WG06, K_WG09, K_WG11, K_WG17 | Lectures | in class tests | Tests grades |
| U1 | Student can independently define the optimization task, build a mathematical model of the objective function and constraints. He can run optimization using software dedicated to it as well as use software for numerical calculations. He can interpret the results of optimization. | K_UW02, K_UW03, K_UW04, K_UW10, K_UK16, K_U18 | Project | Projekts | Project grades |
| K1 | A student is able to cooperate and work in a group and understands the non-technical aspects of the engineer-mechanic activity, including the impact on the environment and safety | K_K04, K_K02 | Lectures / Project | Verbal evaluation | Verbal evaluation |

| Literature and teaching aids |
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| <p>Primary literature:</p> <p>1. Jacek Stadnicki, Teoria i praktyka rozwiązywania zadań optymalizacji z przykładami zastosowań technicznych, Wydawnictwo WNT</p> |

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| 2. Ansys manual, Ansys Innovation Space 3. Fusion manual 4. Matlab manual Additional literature: 1. Daniel Inman, Engineering Vibrations, Pearson Education, Inc.; (2008) English 2. Rakowski G., Kacprzyk Z., Metoda elementów skończonych w mechanice konstrukcji, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 1993. Study aids: Materials provided during classes |
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| Student workload required to achieve the assumed learning outcomes – the balance of ECTS credits | | |
|--|--|-----------------|
| Attendance, participation | Student workload [h]. | |
| | Student's self-study hours Classes without a teacher (ZBN) | Classes |
| Participation in lectures/classes/lab | X | 23 [h] |
| Preparation for lectures/classes/lab , Preparation for ... credit / exam | 55 [h] | X |
| Total student workload Preparation for ... credit / exam | 77 [h]/ 3.1 ECTS | 23 [h]/ 0.9ECTS |
| ECTS points per subject | ... ECTS | |

| Additional information, comments |
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| <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, przewlekle chorych).</p> |