

SYLLABUS

Course description

| Course code | | Course | Mechanika konstrukcji | |
|---|----------------------------|---|-----------------------------|------------------------|
| ME/O/I/ST/B14 | | | Mechanics of structures | |
| Language of instruction | | English | | |
| Academic year | | 2025/2026 | | |
| field of study: | | Mechanical Engineering | | |
| | | All | | |
| field of specialisation: | | All | | |
| Educational level | | first-cycle studies | | |
| Education profile | | General academic | | |
| Mode of study | | Full-time studies | | |
| Semester(s) | | 4 | | |
| Affiliation with a group of classes | | B. Group of obligaroty course core subject | | |
| Course status | | Obligatory | | |
| Types of classes, instruction hours, ECTS credits | | Types of classes | Number of instruction hours | Number of ECTS credits |
| | | Lecture | 30 [h] | 6 ECTS |
| | | Classes | 30 [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 | | ECTS |
| | with qualifications | It is used to acquire engineering competences by the student | | 6 ECTS |
| | with science discipline | Mechanical engineering | | 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. Roman Król | | |
| The website of the basic organizational unit | | http://wm.uniwersytetradom.pl | | |
| E-mail address, phone number of the coordinator | | r.krol@uthrad.pl, +48 361 71 12 | | |

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

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|---------------------|--|
| Learning Objective: | C1 – Ability to perform strength analysis of the constructions which consists of rods under complex loading state including statically indeterminate constructions |
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| | <p>C2 – to familiarize Students with the basics of the plate, pipe and thin walled vessels analysis</p> <p>C3 – to develop skills in performing the fatigue life computations and analysis of the structures in the scope of elasto-plastic deformations</p> |
| Curriculum Content: | <p>Lecture:</p> <p>Solving beam diagrams of the statically determinate structures under tension or under bending. Analysis of statically determinate frames. Solving displacements in the statically determinate frames. The Reciprocal Theorem. The superposition method. Energy methods in solving reaction forces and displacements in statically indeterminate beam and frames. Castigliano's Theorem and Menabrea's Theorem. Using Maxwell-Mohr equations and Vereshchagin's Method in solving statically indeterminate reaction forces and reaction moments. Beam diagrams for the statically indeterminate structures. Analysis of the beam deflection line using Clebsch's Method. Analysis of thin-walled vessels.</p> <p>Exercises:</p> <p>Solving complex strength of materials problems concerning statically determinate supporting structures. Solving beam diagrams with internal moments and internal forces of the statically determinate frames. Solving axial stress distribution in the rod structures. Analysis of the statically indeterminate beams using Maxwell-Mohr equations. Solving statically indeterminate reaction forces and reaction moments using Menabrea's Theorem. Solving problems with energy methods. Determining the beam deflection line using Clebsch's Method.</p> <p>Application of the symbolic calculations in the MATLAB environment in the solution of the exercises with the energy methods.</p> <p>Laboratory exercises:</p> <p>Verification of the Strength of Materials' theorems and methods: the Reciprocal Theorem, Vereshchagin's Method. Verification of the statically indeterminate reaction forces and reaction moments solved by the Finite Element Method using Autodesk Nastran In-CAD software and by the theoretical calculations according to Menabrea's Theorem. Verification of the FEM analysis of structures using energy methods. Solving displacements of the statically indeterminate frames on the basis of the beam diagrams obtained as a result of the FEM analysis.</p> |
| Didactic (educational) methods: | traditional |
| Course assessment type, the criteria for assessing the achieved learning outcomes, and the method of calculating the final grade: | The condition for passing the course is to achieve all the required learning out comes specified for 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 | has knowledge in the area of strength analysis of basic mechanical structures; | K_WG06 | Lecture/ Class/ Lab | Reports, tests, problems, examination | |
| W2 | has knowledge of numerical methods used in simulation and analysis of mechanical | K_WG17 | Lecture/ Lab | Reports, problems | |

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|----|---|--------|---------------------------|--|----------------------|
| | systems, as well as in the process of their design, manufacturing and operation; | | | | |
| U1 | is able to use computer methods in solving engineering tasks in the field of design, manufacturing and operation of machinery and equipment; | K_UW05 | Lab | | |
| U2 | can use measurement apparatus and methods of estimating measurement errors; | K_UW06 | Lab | | |
| K1 | is ready to complete and critically evaluate specialized knowledge and is able to select sources of knowledge and methods of learning appropriate for himself/herself and others; | K-KK01 | Lecture/ Class/ Lab | | Verbal assessment |
| K2 | is willing to comprehensively analyze and effectively carry out assigned tasks, and in the event of difficulties in solving them, use expert opinion; | K-KK02 | Lecture/ Class/ Lab | | Verbal assessment |

| Literature and teaching aids | |
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| <p>Primary literature:</p> <ol style="list-style-type: none"> 1. Brzoska Z., Wytrzymałość materiałów, PWN, Warszawa, 1983. 2. Niezgodziński M. E., Niezgodziński T., Zadania z wytrzymałości materiałów, Wydawnictwo Naukowe PWN SA, Warszawa 2016 (reprinted e-book) 3. Niezgodziński M. E., Niezgodziński T., Wytrzymałość materiałów, PWN, Warszawa, 2002. 4. Niezgodziński M. E., Niezgodziński T., Wzory wykresy i tablice wytrzymałościowe, WNT, Warszawa, 1996. 5. Den Hartog J. P., Strength of materials, McGraw-Hill Book Company Inc., USA 1949 (reprinted ebook) 6. Den Hartog J. P., Advanced strength of materials, McGraw-Hill, New York 1952 (reprinted ebook) <p>Additional literature:</p> <ol style="list-style-type: none"> 1. Timoschenko S., Goodier J. N., Theory of elasticity, McGraw-Hill Book Company Inc., New York, 1951 <p>Study aids:</p> <p>Lecture notes in Microsoft Power Point</p> | |

| 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 | 75 [h] |
| Preparation for lectures/classes/lab , Preparation for ... credit / exam | 75 [h] | X |
| Total student workload Preparation for ... credit / exam | 75 [h]/3 ECTS | 75 [h]/3 ECTS |
| ECTS points per subject | 6 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, przewlekłe chorych).</p> |

