COURSE DESCRIPTION CARD

<table>
<tr><td colspan="10">Faculty of Mechanical Engineering</td></tr>
<tr><td>Field of study</td><td colspan="6"></td><td colspan="2">Degree level and programme type</td><td>Bachelor's degree
Master's degree</td></tr>
<tr><td>Specialization/ diploma path</td><td colspan="6"></td><td colspan="2">Study profile</td><td></td></tr>
<tr><td rowspan="2">Course name</td><td colspan="6" rowspan="2">Strength of Materials</td><td colspan="2">Course code</td><td>IS-MER003W</td></tr>
<tr><td colspan="2">Course type</td><td>Elective</td></tr>
<tr><td rowspan="2">Forms and number of hours of tuition</td><td>L</td><td>C</td><td>LC</td><td>P</td><td>SW</td><td>FW</td><td>S</td><td colspan="2">Semester</td><td>Winter</td></tr>
<tr><td>30</td><td>30</td><td>15</td><td></td><td></td><td></td><td></td><td colspan="2">No. of ECTS credits</td><td>6</td></tr>
<tr><td>Entry requirements</td><td colspan="9"></td></tr>
<tr><td>Course objectives</td><td colspan="9">The course provides students with knowledge of the basic terms, assumptions, principles and methods of Strength of Materials. Problems of tension, compression, torsion, bending and combined loading are systematically considered. Advanced problems related to static indeterminacy, buckling instability and elastoplastic behaviour are also treated. The main emphasis is on the development of skills to efficiently schematise, solve and analyse typical problems.</td></tr>
<tr><td>Course content</td><td colspan="9">1. Introduction. Internal forces. Normal and shear stresses. Deformations. Normal and shear strains. Stress–strain diagram. Elastic and plastic behaviour. Yield stress. Ultimate stress. Working stress. Safety factor. 2. Geometry of cross-sections. Static moments. Centroid. Moments of inertia. Parallel-axis theorem. Principal axes. Principal moments of inertia. 3. Tension and compression. Axial force. Saint Venant’s principle. Hooke's law. Elastic modulus. Poisson's ratio. Thermal expansion coefficient. 4. Torsion. Twisting moment. Angle of twist. Shear modulus. 5. Bending stresses. Bending moment. Neutral axis. Flexure formula. Efficient cross sections. Bending with shear. Shear formula. 6. Bending deflections. Equation of the elastic curve. Double-integration method. Bracket function. 7. Combined loading. Skew bending. Eccentric axial loading. 8. Strength theories. Stress state at a point. Principal stresses. Mohr’s circles. Equivalent stress. 9. Energy theorems. Strain energy. Castigliano’s theorem. Principle of stationary potential energy. Betti’s theorem. 10. Force method. Redundant reaction. Degree of static indeterminacy. Statically determinate equivalent structure. 11. Stability of bars. Buckling. Critical load. Euler’s formula. Energy method. 12. Elastoplastic behaviour. Yield loading. Limit loading. Plastic neutral axis.</td></tr>
<tr><td>Teaching methods</td><td colspan="9">Regular/online lectures: blackboard lectures, presentations by teacher, discussions.
Regular/online classes: blackboard classes, discussions.
Work at home: home assignments, preparation for exams.</td></tr>
<tr><td>Assessment method</td><td colspan="9">Home assignment reports, exam reports</td></tr>
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Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
LO1	Demonstrate knowledge of the basic terms, assumptions, principles and calculation methods of Strength of Materials.	M1_W04, M1_W05, M1_W11
LO2	Demonstrate ability to solve problems of tension, compression, torsion and bending for a single bar.	M1_W04, M1_W05, M1_U19
LO3	Demonstrate ability to determine and analyse the stress state of a structure subjected to a combined loading.	M1_W04, M1_W05, M1_U19
LO4	Demonstrate ability to apply the energy theorems and force method for solving statically indeterminate problems.	M1_W04, M1_W05, M1_U19
LO5	Demonstrate ability to solve problems of buckling instability and elastoplastic behaviour.	M1_W04, M1_W05, M1_U19
Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO1	Home assignment report, exam report	C
LO2	Home assignment report, exam report	C
LO3	Home assignment report, exam report	C
LO4	Home assignment report, exam report	C
LO5	Home assignment report, exam report	C
Student workload		No. of hours
Calculation	Attendance of regular/online lectures	30
	Attendance of regular/online classes	45
	Work on home assignments	45
	Preparation for exams	30
	TOTAL:	150

Quantitative indicators	No. of hours	No. of ECTS credits
Student workload – activities that require direct teacher participation	75	6
Student workload – self study	75	

Basic references	1. A. Pytel, J. Kiusalaas, Mechanics of Materials, 2nd ed., Cengage Learning, 2012. 2. J.M. Gere, B.J. Goodno, Mechanics of Materials: Brief Edition, Cengage Learning, 2012. 3. W.A. Nash, M.C. Potter, Schaum's Outlines: Strength of Materials, 5th ed., McGraw-Hill, 2011.
Supplementary references	1. S. Timoshenko, Strength of Materials, 2nd ed., D. Van Nostrand Company, 1940. 2. A.P. Boresi et al., Advanced Mechanics of Materials, 5th ed., John Wiley & Sons, 1993. 3. V.D. da Silva, Mechanics and Strength of Materials, Springer, 2006.
Organisational unit conducting the course	Department of Mechanics and Applied Computer Science — Date of issuing the programme
Author of the programme	Dr Oleksii Nosko — 19.03.2021

L – lecture, C – classes, LC – laboratory classes