# GDAŃSK UNIVERSITY OF TECHNOLOGY

## Subject card

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| Subject name and code | Mechanics of solids and fluids I, PG_00039790 |
| Field of study | Materials Engineering, Materials Engineering, Materials Engineering |

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| Date of commencement of studies | October 2021 | Academic year of realisation of subject | 2022/2023 |
| Education level | first-cycle studies | Subject group | Obligatory subject group in the field of study |
| | | | Subject group related to scientific research in the field of study |
| Mode of study | Full-time studies | Mode of delivery | at the university |
| Year of study | 2 | Language of instruction | Polish |
| Semester of study | 3 | ECTS credits | 4.0 |
| Learning profile | general academic profile | Assessment form | assessment |

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| Conducting unit | Department of Mechanics and Mechatronics -> Faculty of Mechanical Engineering and Ship Technology |

| Name and surname of lecturer (lecturers) | Subject supervisor | dr hab. inż. Krzysztof Lipiński |
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| | Teachers | dr hab. inż. Krzysztof Lipiński |
| | | dr inż. Piotr Patrosz |

| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|---|
| | Number of study hours | 30.0 | 15.0 | 0.0 | 0.0 | 0.0 | 45 |
| | E-learning hours included: 0.0 | | | | | | |

| Learning activity and number of study hours | Learning activity | Participation in didactic classes included in study plan | Participation in consultation hours | Self-study | SUM |
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| | Number of study hours | 45 | 5.0 | 50.0 | 100 |

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| Subject objectives | Acquainting students with the essential law of mechanics and forming abilities of solving problems practical, in static issues and kinematics of the point. |

| Learning outcomes | Course outcome | Subject outcome | Method of verification |
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| | K6_U06 | Is able to integrate obtained information, make their interpretations, as well as draw conclusions and formulate and justify opinions in the field of solid and fluid mechanics | [SU4] Assessment of ability to use methods and tools |
| | K6_K01 | understands the need to improve professional competence in the field of solid state mechanics; is aware of its own limitations and knows when to turn to experts, can properly set priorities for the implementation of its or other tasks | [SK5] Assessment of ability to solve problems that arise in practice |
| | K6_W05 | has knowledge of the statics of a convergent and arbitrary system of forces, both in relation to a solid and a system of solids, and kinematics of a point and a solid in planar motion - two fundamental branches of general mechanics | [SW1] Assessment of factual knowledge |

| Subject contents | LECTURES: Introduction: Organization of occupations and the literature of object. Historical outline. Mechanic and its main sub-disciplines. Modelling in mechanics: the real objects, physical model, mathematical model the, ideally stiff body, the material point, force concentrated. Scalar and vector quantities. Newton"s laws. Primary notions and axioms. Equivalent sets of forces. Moment of force. The degrees of freedom, constraints and their reactions. Statically determinate, indeterminate and unstable sets of bodies. The coupe of forces and its moment. Resultant force and resultant moment. Statics: Basic notions. Force and their source. The division of forces: active and passive forces, external and internal forces. The conditions of equilibrium of arbitrary arranged forces. Alternative conditions of equilibrium. The principle of independence of effects of forces - the principle of superposition. Gravity force, centre of gravity and the notion of static moment. Sliding friction, friction the cords, rolling resistance. Use of matrix calculus and the computer methods in mechanics. Trusses. Kinematics: The principal notions of kinematics of point: the position, speed and the acceleration, equation of movement. The description of movement of point in coordinates: vectorial, rectangular, normal as well as polar. Tangent and normal acceleration. Special cases of movement of point. Kinematics of rigid body. Principal notions. Description of the position of rigid body, speed and angular acceleration of rigid body as well as speed and acceleration of points that belong to rigid body. Special cases of movement of rigid body: translation, rotation, uniplanar motion. Relative motion. Acceleration of Coriolis.EXERCISES: Repetition with vectorial calculus. Vectorial nature of forces. The principle of two forces. Elimination of constraints of bodies, force of reaction of constraints. Orthogonal projection of vector on axis. Moment of force in respect to point and in respect to axis. Equilibrium of any arbitrary arranged sets of forces. Calculation of the coordinates of centres of gravity, mass . Equilibrium of sets with friction. Kinematics of point: differentiating and the integration of the equations of motion. Kinematics of arrangement of points. Kinematics of rigid body, instantaneous centre of velocity. |
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| Prerequisites and co-requisites | The command of physics and the mathematics on level of school of average, in this particularly: geometry and trigonometry, differential calculus, vectoral and matrix calculus. |

| Assessment methods and criteria | Subject passing criteria | Passing threshold | Percentage of the final grade |
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| | | 56.0% | 50.0% |
| | | 56.0% | 50.0% |

| Recommended reading | Basic literature | Wittbrodt E., Sawiak S.: Mechanika ogólna. Teoria i zadania. Wyd. PG, Gdańsk 2012 |
|---|---|---|
| | Supplementary literature | Leyko J.: Mechanika ogólna, t. 1 i 2, PWN, Warszawa 2004 |
| | | Osiński Z.: Mechanika ogólna, PWN, Warszawa 1994 |
| | | Nizioł J.: Metodyka rozwiązywania zadań z mechaniki. WNT, Warszawa 2002 |
| | | Sawiak S., Wittbrodt E.: Mechanika. Wybrane zagadnienia. Teoria i zadania. Wyd. PG, Gdańsk 2007 |
| | eResources addresses | Adresy na platformie eNauczanie:  Mechanika ciała stałego i płynów I , W/C, IM, sem.03, zimowy 22/23 (PG_00039790) - Moodle ID: 26809 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=26809 |

| Example issues/ example questions/ tasks being completed | 1. projection of forces onto the axis |
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| | 2. dot product of vectors |
| | 3. vector product of vectors |
| | 4. composing and decomposing of forces (analytically and graphic) |
| | 5. moment of force with the respect to the point and with respect to the axis |
| | 6. reduction in the free sets of forces to a single force and to a single pair of forces (the main force and the main moment) |
| | 7. invariants of the sets of forces |
| | 8. conditions of the equilibrium of the free agreement of forces |
| | 9. conditions of the equilibrium of special cases of forces (plat, coincident and parallel agreements) |
| | 10. Alternative conditions of the equilibrium of plat agreements of forces |
| | 11. constraints and their reactions |
| | 12. arrangements statically determinable, undeterminable and unstable |
| | 13. lateral friction |
| | 14. Cone of friction |
| | 15. friction of cords |
| | 16. rolling resistance |
| | 17. typical methods used to determine the coefficient of friction |
| | 18. the centres of gravity, the notion and formulas |
| | 19. the centres of gravity for homogeneous lines |
| | 20. the centres of gravity for homogeneous plane figures |
| | 21. the centres of gravity for homogeneous 3D bodies |
| | 22. description of the movement of point in the rectangular coordinates |
| | 23. description of the movement of point with use of the leading vector |
| | 24. description of the movement of point in the natural coordinates |
| | 25. path of the particle |

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| | 26. the definition of the linear speed and the linear accelerations |
| | 27. tangent and normal acceleration |
| | 28. uniform and monotonously accelerated linear motion |
| | 29. circular motion of particel |
| Work placement | Not applicable |