



Subject card

| | | | | | | | |
|---|--|--|-------------------------------------|------------|------------------------|---------|-----|
| Subject name and code | Fluid Mechanics, PG_00056193 | | | | | | |
| Field of study | Transport and Logistics | | | | | | |
| Date of commencement of studies | October 2023 | Academic year of realisation of subject | | | 2024/2025 | | |
| Education level | first-cycle studies | Subject group | | | | | |
| 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 | | | 3.0 | | |
| Learning profile | general academic profile | Assessment form | | | assessment | | |
| Conducting unit | Institute of Ocean Engineering and Ship Technology -> Faculty of Mechanical Engineering and Ship Technology | | | | | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr inż. Michał Krężelewski | | | | | |
| | Teachers | dr inż. Michał Krężelewski mgr inż. Olga Kazimierska | | | | | |
| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
| | Number of study hours | 20.0 | 10.0 | 0.0 | 0.0 | 0.0 | 30 |
| | 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 |
| | Number of study hours | 30 | 5.0 | | 40.0 | | 75 |
| Subject objectives | Familiarize students with the basic concepts and laws of fluid mechanics, such as:- density, viscosity, compressibility, surface tension,- Static equilibrium equations of fluid, hydrostatic pressure, fluid forces on straight surfaces, etc.- Continuity equation,- The principle of momentum conservation,- Calculation of hydrodynamic forces,- The principle of conservation of energy for non-viscous fluid, incompressible flow (Bernoulli eq.)- Basic issues of viscous liquid flow, determination of losses in the flow.- The concept of the stress tensor in a real (viscous) fluid. | | | | | | |
| Learning outcomes | Course outcome | | Subject outcome | | Method of verification | | |
| Subject contents | Scope of the course: The main properties of fluids:- The density, viscosity, compressibility, surface tension, Basic concepts:- Particle fluid- The pressure, shear stress,- Pascal's law. Fluid statics:- The hydrostatic equilibrium equations of fluid- The hydrostatic pressure formula,- Pressure force to the flat surface- - The concept of the center of pressure force,- - Calculation of the moment of pressure force.- - Buoyancy, center of buoyancy.- Stability of floating bodies (ships)- - Metacentric radius,- - Metacentric height,- - Equilibrium conditions. The main issues of fluid kinematics:- A description of the motion of fluids:- - Eulerian method,- - Lagrangian method- Determination of position, velocity and acceleration of the fluid,- The concept of the path of the fluid particles (pathline), streamline, streamsurface, streamtube The principle of conservation of mass (continuity equation):- The concept of the mass flow rate the volumetric flow rate,- The concept of control surface, control volume- Calculation of the flow velocity at varying cross channel The principle of conservation of energy for perfect fluid, incompressible flow (Bernoulli's equation):- Solving one-dimensional flow problems in channels: determination of the flow rate and pressure. The principle of conservation of momentum,- The concept of a volume of liquid,- Guiding principles of conservation of momentum in the form of integral,- Calculation of hydrodynamic forces, The concept of the stress tensor in a real(viscous) fluid. Basic issues of the real fluid flow, determination of loss in the flow:- Generalized Bernoulli equation,- Determining the amount of local loss and linear :- - Types of flow of real fluids:- - - Laminar flow- - - Transitional flow,- - - Turbulent flow | | | | | | |
| Prerequisites and co-requisites | Knowledge of the basic concepts of physics / mechanics:- Force (force vector)- Torque,- The arm of force,- What is the pressure (?)- Momentum, potential energy, kinetic energy,- Knowledge of units related to above concepts, Knowledge of the basic concepts of calculus / calculus- Definite integral,- Derivative of the function,- Basic ability to apply integrals in problems of physics- Ordinary differential equations with separated variables- The surface integral, volume integral Knowledge of algebra:- The transformation of algebraic expressions,- The ability to "take before the parenthesis" (!!!)Algebra of vectors:- The scalar product,- Vector product,- Vector component,- The projection of the vector on the direction of the specified unit vector Knowledge of trigonometric functions- Sine, cosine, tangent, cotangent Basic knowledge of stereometry (3D geometry)- Eg .: calculating the volume of a cylinder, cuboid, and the like.- Eg .: calculating the area of the cylinder Knowledge of floating point notation, eg .: * 10 ^ 6- Ability to use scientific calculator. | | | | | | |

| Assessment methods and criteria | Subject passing criteria | Passing threshold | Percentage of the final grade |
|--|--------------------------|--|-------------------------------|
| | Exercises – Colloquium | 50.0% | 60.0% |
| | Lecture - Colloquium | 50.0% | 40.0% |
| Recommended reading | Basic literature | <p>Teoria (wykład):</p> <p>[1] R. Puzyrewski, J. Sawicki: Podstawy mechaniki płynów i hydrauliki. Wydawnictwo Naukowe PWN, Warszawa 2000</p> <p>[2] R. Gryboś: Podstawy mechaniki płynów. Wydawnictwo Naukowe PWN, Warszawa 1998</p> <p>Zadania (ćwiczenia):</p> <p>[3] R. Gryboś: Zbiór zadań z technicznej mechaniki płynów. Wydawnictwo Naukowe PWN, Warszawa 2002</p> <p>[4] E.S. Burka: Mechanika Płynów w Przykładach. Wydawnictwo Naukowe PWN, Warszawa 1994</p> | |
| | Supplementary literature | <p>[5] Bar-Meir, Genick, Basics of Fluid Mechanics, Last modified: Version 0.3.4.0 March 17, 2013, www.potto.org/downloads.php</p> <p>[6] Yunus A. Çengel, John M. Cimbala: Fluid Mechanics. Fundamentals and Applications. McGraw Hill Higher Education, Boston, 2006</p> <p>[7] W.J. Prosnak: Mechanika Płynów (Tom I). Państwowe Wydawnictwo Naukowe, Warszawa 1970.</p> <p>[8] J. Bukowski: Mechanika Płynów. Państwowe Wydawnictwo Naukowe, Warszawa 1959.</p> | |
| | eResources addresses | Adresy na platformie eNauczenie: | |
| Example issues/ example questions/ tasks being completed | | | |
| Work placement | Not applicable | | |

Document generated electronically. Does not require a seal or signature.