GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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| Subject name and code | Physics, PG_00055815 | | |
| Field of study | Ocean Engineering | | |
| Date of commencement of studies | October 2022 | Academic year of realisation of subject | 2022/2023 |
| Education level | first-cycle studies | Subject group | Obligatory subject group in the field of study |
| Mode of study | Full-time studies | Mode of delivery | at the university |
| Year of study | 1 | Language of instruction | Polish |
| Semester of study | 1 | ECTS credits | 6.0 |
| Learning profile | general academic profile | Assessment form | assessment |
| Conducting unit | Faculty of Ocean Engineering and Ship Technology | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr hab. inż. Małgorzata Śmiałek-Telega | |
| | Teachers | dr hab. inż. Małgorzata Śmiałek-Telega<br>mgr inż. Irena Dziwisz-Olszak<br>dr inż. Joanna Grochowalska | |

**Lesson types and methods of instruction**

| Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|
| Number of study hours | 30.0 | 15.0 | 15.0 | 0.0 | 0.0 | 60 |

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 | 60 | 12.0 | 78.0 | 150 |

**Subject objectives**

Acquisition of basic knowledge from selected branches of classical and modern physics. Gaining skills of qualitative understanding of selected principles and laws of classical and contemporary physics and quantitative analysis of selected phenomena in this field. Learning basic techniques and methods measurement of selected physical quantities

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
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| [K6_W02] has a basic knowledge in physics, including technical mechanics, fluid mechanics, solid-state physics, optics and acoustics necessary to understand basic physical phenomena occurring in ocean technology | Has knowledge of the basics of physics in the scope presented in the lecture; independently, in writing or in oral speech, correctly and concisely present the issues discussed during the lectures, which are the content of the subject learning outcomes in the field of knowledge; apply the transferred and described knowledge to the analysis of selected engineering issues | [SW1] Assessment of factual knowledge |
| [K6_U02] can work individually and in a team, communicate through various techniques in professional environment and also record, analyse, and present the results of work, can estimate the time needed to complete a given task | Has the skills needed for individual and group work, can estimate the time needed to complete the entrusted task | [SU5] Assessment of ability to present the results of task<br>[SU4] Assessment of ability to use methods and tools<br>[SU2] Assessment of ability to analyse information<br>[SU1] Assessment of task fulfilment |

| Subject contents | |
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Measurement and mathematical introduction

- Measurements and units (length, time, weight)
- Working with numbers
- How to change units
- Trigonometry
- Derivative
- Integral

Movement in a straight line

- Motion
- Position and displacement
- Average speed and speed
- Instantaneous speed and speed
- Acceleration
- Constant acceleration
- Another look at constant acceleration
- Free fall acceleration
- Vectors and 2D and 3D motion
- Vectors and scalars
- Geometric addition of vectors
- Components of vectors
- Unit vectors
- Adding vectors by components
- Vectors and laws of physics
- Vector multiplication
- Moving in 2 and 3 dimensions
- Position and displacement
- Average and instantaneous speed
- Average and instantaneous acceleration
- Projectile movement
- Projectile motion analysis
- Uniform circular traffic
- Relative movement

Force and Motion

- What causes acceleration?
- Newton's first law of motion
- Strength
- Mass
- Newton's second law of motion
- Special force cases (gravity, weight, normal force, friction, stress)
- Newton's third law of motion
- Applying Newton's laws
- Friction
- Properties of friction
- Resistance force and end speed
- Uniform circular motion

Kinetic Energy and Work, Potential Energy & Conservation of Energy

- Energy
- work
- Work and kinetic energy
- Work done by the force of gravity
- Work done by spring force
- Work done by general variable force
- Power
- Potential energy
- The way and conservative forces
- Determining the value of potential energy
- Conservation of mechanical energy
- Reading the Potential Energy Curve
- Work done in the system by external forces
- Conservation of energy

Gravity, systems of material points and collisions

- Our galaxy and the force of gravity
- Newton's law of gravity
- Gravity and the principle of superposition
- Gravity near the Earth's surface
- Gravity inside the Earth
- Gravity potential energy (track independence, potential energy and force, escape velocity)
- Planets and satellites: Kepler's laws
- Satellites: orbits and energy
- Einstein and gravity (the principle of equivalence, the curvature of space)
- Special point - Center of mass
- Newton's second law concerning the system of material points
- Momentum
- Linear momentum of a system of material points

- Rocket
- Collisions
- Pulse and linear momentum
- Momentum and kinetic energy
- Inelastic collisions in one dimension
- Elastic collisions in one dimension
- Collisions in 2D

Rotation, turning, torque and angular momentum

- Translation and rotation
- Rotational motion variables (angular position, angular displacement, angular velocity, angular acceleration)
- Rotating vectors
- Rotation and constant angular acceleration
- Relation of linear and angular variables
- Kinetic energy of rotational motion
- Calculation of inertia in rotational motion
- Moment of force in rotational motion
- Newton's second law of rotation
- Work and kinetic energy in rotational motion

Balance and elasticity, Oscillations

- Balance
- Balance requirements
- Center of gravity
- Some examples of static balance - problem solving tactics
- Unspecified structures
- Elasticity (tension and compression, shear, hydraulic stress)
- Oscillations
- Simple harmonic motion
- speed of PRH
- acceleration of PRH
- The law of force for PRH
- Energy in PRH
- Simple angular harmonic oscillator
- Pendulums
- simple pendulum,
- physical pendulum,
- "g" measurement
- PRH and uniform circular motion
- Suppressed PRH
- Forced oscillations and resonance

Waves

- Waves and particles
- Types of waves
- Transverse and longitudinal waves
- Wavelength and frequency
- The speed of the traveling wave
- Wave speed on a stretched string
- Energy and power in a traveling wave of strings
- The wave equation
- The principle of wave superposition
- Wave interference
- Standing waves and resonance
- Introduction
- Sound waves
- The speed of sound
- Movement of sound waves
- Interference
- Sound intensity and level - decibel scale
- Sources of musical sounds
- Beats
- Doppler effect (detector motion, stationary source, moving source, stationary detector, bat navigation)
- Supersonic speeds; Shock waves

Hydromechanics

- Fluids: static conditions
- Pressure
- Pascal's law (hydraulic jacks, etc.)
- Archimedes' law
- Fluid dynamics
- Bernoulli equation
- Application examples

Thermodynamics and heat. Kinetic theory of gases

- Thermal expansion
- Heat transfer
- Heat

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| | • Heat exchange processes<br>• Conduction, convection, radiation and application<br>• Kinetic theory of an ideal gas<br>• The ideal gas law<br>• Diffusion<br>• The zero law of thermodynamics<br>• The first law of thermodynamics and applications<br>• Motors (work-heat)<br>• Efficiency<br>• Entropy and the second law of thermodynamics<br><br>Electric charge and electric field<br><br>• Electric charge<br>• Principle of conservation of charge<br>• Electric field (Electric field lines, Dipole in an electric field - potential energy of an electric dipole)<br><br>Electric capacity, current and resistance<br><br>• Gauss's law<br>• Electric field flux<br>• Gauss's law and Coulomb's law<br>• Application of Gauss's law<br>• Electric field potential<br>• Equipotential surfaces<br>• Electric potential energy<br><br>Magnetic field, induction and inductance<br><br>• Applications of capacitors<br>• Capacity<br>• Capacity calculation<br>• Capacitors - parallel and series connection |
| Prerequisites and co-requisites | |
| Assessment methods and criteria | |

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| problems | 50.0% | 50.0% |
| lecture | 50.0% | 50.0% |

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| Recommended reading | Basic literature | |
| | Supplementary literature | |
| | eResources addresses | Adresy na platformie eNauczanie:<br>PG_00055815_ Fizyka I - Oceanotechnika 22/23 - Moodle ID: 24958<br>https://enauczanie.pg.edu.pl/moodle/course/view.php?id=24958 |
| Example issues/ example questions/ tasks being completed | 1. Give the second principle of dynamics and conclusions resulting from it<br><br>2. What are conservative and non-conservative forces; how much is the work they do; Provide examples of conservative and non-conservative forces<br><br>3. Give examples of systems moving in a harmonic way; What equation describes the harmonic motion straight?; Write and draw the dependence of the deflection from the position of the equilibrium from time; What happens if the frequency of the forcing force is close to the natural frequency of the system?<br><br>4. Draw and describe the serial connection of three capacitors with capacities C1, C2 and C3; Set dependence on<br>equivalent capacity<br><br>5. Ohm law for the closed circuit: give the formula and explain it in the diagram with the current source and the receiver<br><br>6. Give and explain the formula for Lorentz strength. How he changes<br>a return of strength depending on the signs of the load (draw)? | |
| Work placement | Not applicable | |