Zachodniopomorski Uniwersytet Technologiczny w Szczecinie

**Faculty of Food Sciences and Fisheries**

| | | | |
|---|---|---|---|
| *Field of study* | Aquaculture and Fisheries | | |
| *Mode of study* | stationary | *Level* | first cycle |
| *Graduate's qualification* | inżynier | | |
| *Fields of science* | agricultural sciences | | |
| *Disciplines of science* | animal science and fisheries (100%) | | |
| *Educational profile* | general academic | | |
| *Module* | | | |
| *Course unit* | **Physics of aquatic environment** | | |
| *Code* | WNOZIR/AQF/S1/ | | |
| *Field of specialisation* | | | |
| *Administering faculty* | Department of Bioengineering | | |
| *ECTS* | 4.0 | *ECTS (forms)* | 4.0 |
| *Form of course credit* | examination | *Language* | english |
| *Electives* | | *Elective group* | |

| *Form of instruction* | *Cod* | *Semester* | *Hours* | *ECTS* | *Weight* | *Credit* |
|---|---|---|---|---|---|---|
| laboratory course | L | 2 | 30 | 2.0 | 0.50 | credits |
| lecture | W | 2 | 30 | 2.0 | 0.50 | examination |

| | |
|---|---|
| *Leading teacher* | Mielnik Lilla (Lilla.Mielnik@zut.edu.pl) |
| *Other teachers* | |

| *Prerequisites* | |
|---|---|
| *W-1* | Basic knowledge of physics, mathematics and chemistry at the high school level |

| *Module/course unit objectives* | |
|---|---|
| *C-1* | The ability to see and understand the basic physical and biophysical phenomena observed in seas and oceans |
| *C-2* | Acquiring the ability to conduct simple experiments |

| *Course content divided into various forms of instruction* | | *Number of hours* |
|---|---|---|
| *T-L-1* | Introduction to laboratory classes - workshop regulations, Quality assessment of obtained measurement results, analysis of measurement uncertainty account. | 2 |
| *T-L-2* | Practical-implementation classes for the uncertainty calculus | 2 |
| *T-L-3* | Molecular physics and fluid mechanics laboratories classes | 6 |
| *T-L-4* | Laboratory classes of thermodynamics | 6 |
| *T-L-5* | Laboratory classes of conductometric and spectroscopic measurements | 6 |
| *T-L-6* | Optics and radioactivity laboratory classes | 6 |
| *T-L-7* | Passing classes | 2 |
| *T-W-1* | Water as a physical environment. Global water distribution, the water cycle. The water's structure in various physical states. The anomalous properties of water. | 2 |
| *T-W-2* | Sea water and its properties: physical, chemical and biological components of sea water. Salinity of sea water - salinity distribution. Salinity measurement of sea water. | 2 |
| *T-W-3* | Elements of thermodynamics. Temperature as an ecological factor. Principles of thermodynamics. Thermodynamic parameters of sea water: density and specific volume of sea water. The Equation of state of sea water. | 2 |
| *T-W-4* | Molecular transport - mass and momentum transfer processes in the sea. General transport equation, diffusion, osmosis. | 2 |
| *T-W-5* | Heat transfer mechanisms - thermal conduction (Fourier's law), thermal convection, thermal radiation, Stefan-Boltzmann's law, Wien law. Emission and absorption of thermal radiation and their importance for the movement of water masses. | 2 |
| *T-W-6* | Elements of hydrostatics. General characteristics of the liquid: hydrostatic pressure, fluid equilibrium conditions in connected vessels, definition of a perfect liquid, Pascal's law, Archimedes' law, swimming conditions of bodies. | 2 |
| *T-W-7* | Elements of hydrodynamics. Basic terms: volume flow, volume flow density. Perfect fluid motion - continuity equation, Bernoulli's law. Movement of real liquids - Newton's equation - fluid viscosity phenomenon. | 2 |
| *T-W-8* | Hydrodynamics of real liquids (Reynolds criterion, stationary flow, turbulent flow, shear stress in stationary and turbulent flows). | 2 |
| *T-W-9* | Surface tension in liquids. Phenomena at the interface of contact liquid-solid. Adhesive or cohesive forces, formation of meniscus in liquids, capillarity. Surface active substances (surfactants). | 2 |
| *T-W-10* | Newton’s law of universal gravitation. Inertia forces in translational and rotational movement- Coriolis force, the Ekman spiral. Sea currents, upwelling/downwelling, tides. | 2 |

| *Course content divided into various forms of instruction* | | *Number of hours* |
|---|---|---|
| *T-W-11* | Elements of wave motion - basic wave parameters. Refraction, interference and diffraction of waves. The sea waving. Different types of sea waves. | 2 |
| *T-W-12* | Fundamentals of geometrical optics. Snelius' laws. Total internal reflection, light scattering, light absorption - Lambert-Beer law. Real and apparent optical properties of sea, sea albedo, solar constant, optical classification of water. | 3 |
| *T-W-13* | Acoustic wave formation - basic terms: acoustic wave speed, loudness, timbre, speed of sound propagation in the sea. Sound channels in the sea, convergence zone. Noise in the sea, sounds made by fish and other inhabitants of the sea. | 3 |
| *T-W-14* | Electrical properties of water: dipole moment, dielectric constant water as a solvent, electrolytic dissociation, electrostriction, electrolytic conductivity. | 2 |

| *Student workload - forms of activity* | | *Number of hours* |
|---|---|---|
| *A-L-1* | participation in laboratory classes | 30 |
| *A-L-2* | Preparation of reports on laboratory classes | 10 |
| *A-L-3* | Preparing for laboratory classes | 10 |
| *A-L-4* | Preparing to pass classes | 5 |
| *A-L-5* | Participation in consultations | 5 |
| *A-W-1* | participation in lectures | 30 |
| *A-W-2* | Preparing to pass exam | 12 |
| *A-W-3* | Participation in consultations | 5 |
| *A-W-4* | reading the literature | 12 |

| *Teaching methods / tools* | |
|---|---|
| *M-1* | Informative lecture using a projector |
| *M-2* | practical classes - performing laboratory experiments |
| *M-3* | Discussion, explanations |

| *Evaluation methods (F - progressive, P - final)* | | |
|---|---|---|
| *S-1* | P | Grade for passing lectures |
| *S-2* | P | Assessment of reports prepared on exercises performed. |
| *S-3* | P | Grade from written pass of laboratory classes |
| *S-4* | F | Assessment of student activity during classes |

| Designed learning outcomes | Reference to the learning outcomes designed for the fields of study | Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8 | Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences | Course objectives | Course content | Teaching methods | Evaluation methods |
|---|---|---|---|---|---|---|---|
| *Knowledge* | | | | | | | |
| AQF_1A_B10_W01<br>The student has basic knowledge in the field of aquatic environment physics and biophysics.The student knows the basic concepts, correctly formulates definitions, laws and principles of physics.He can describe and explain the basic phenomena occurring in the natural environment. | AQF_1A_W01 | P6S_WG | P6S_WG | C-1 | T-W-1 T-W-8<br>T-W-2 T-W-9<br>T-W-3 T-W-10<br>T-W-4 T-W-11<br>T-W-5 T-W-12<br>T-W-6 T-W-13<br>T-W-7 T-W-14 | M-1<br>M-3 | S-1 |
| *Skills* | | | | | | | |
| AQF_1A_B10_U01<br>The student knows how to plan and perform simple experiments in physics, and make measurements of basic physical quantities. He can carry out appropriate calculations, interpret the obtained results and formulate conclusions. The student can work independently and in a team. The student is able to use professional literature, knows where and how to look for information necessary to improve his skills. | AQF_1A_U01<br>AQF_1A_U08 | P6S_UW | P6S_UW | C-1<br>C-2 | T-L-2 T-L-5<br>T-L-3 T-L-6<br>T-L-4 | M-2<br>M-3 | S-2<br>S-3<br>S-4 |
| *Social competences* | | | | | | | |
| AQF_1A_B10_K01<br>The student is aware of the importance of biophysical phenomena occurring in the natural environment. The student shows a need / willingness to expand knowledge. The student is able to work independently and cooperate in a group, plans the work correctly. She/he ensures a compilance with the rules of the team work, cares about his own safety and that of others while performing the experiments. It respect its own work and that of others, is aware of the importance of work performed. The student respects the views and culture of others. | AQF_1A_K01<br>AQF_1A_K02<br>AQF_1A_K03 | P6S_KK<br>P6S_KO<br>P6S_KR | | C-1 | T-L-1 T-L-4<br>T-L-2 T-L-5<br>T-L-3 T-L-6 | M-1<br>M-2<br>M-3 | S-2<br>S-4 |

| Outcomes | Grade | Evaluation criterion |
|---|---|---|
| *Knowledge* | | |
| AQF_1A_B10_W01 | *2,0* | The student does not have sufficient basic knowledge in the field of sea and ocean physics. |
| | *3,0* | The student mastered the material from the lectures sufficiently. He knows the basic laws, principles and physical phenomena characterizing the aquatic environment. |
| | *3,5* | |
| | *4,0* | |
| | *4,5* | |
| | *5,0* | The student has a very extensive knowledge of the physics and biphysics of the seas and oceans. The student independently describes physical phenomena, correctly explains them using the laws of physics, critically analyzes them, and correctly associates them. |
| *Skills* | | |
| AQF_1A_B10_U01 | *2,0* | The student is not able to independently carry out laboratory experiments using simple measuring instruments. In no way participates in teamwork. Has no ability to perform basic physical calculations. |
| | *3,0* | The student is not able to carry out the experiments independently, requires the help of the teacher - passively participates in group work, does not take their own initiatives. He can correctly prepare a report, but presents "dry" results without the ability to effectively analyze them. |
| | *3,5* | |
| | *4,0* | |
| | *4,5* | |
| | *5,0* | The student is able to independently carry out measurements of physical quantities. He actively participates in group work, is able to organize team activities, undertakes his own initiatives. He can prepare a report very well. He can choose the appropriate method to assess the uncertainty of measurement results. Effectively presents, analyzes and discusses the obtained result. |
| *Other social competences* | | |
| AQF_1A_B10_K01 | *2,0* | The student is not aware of the importance of physical processes in the world around us, he does not understand the need to acquire and deepen knowledge. The student does not participate in any group work. I do not respect my own work and that of others. |
| | *3,0* | The student is sufficiently aware of the importance of biophysical and physical processes occurring in the world around us, does not understand the need to acquire and deepen knowledge. Passively participates in teamwork. I do not respect my own work and that of others. |
| | *3,5* | |
| | *4,0* | |
| | *4,5* | |
| | *5,0* | The student is very well aware of the importance of physical processes in the world around us, understands the need to acquire and deepen knowledge. I respect my work and that of others. Can work independently and in a team. Manages teamwork, shows creativity. Is aware of the responsibility for his and others' safety. |

*Required reading*

1. Matthew D. McCluskey, No-Frills Physics A Concise Study Guide for Algebra-Based Physics, Taylor & Francis group, Boca Raton, 2019, 1, https://doi.org/10.1201/9780429506437

2. Paul G. Hewitt, Conceptual Physics, ddison-Wesley, 1998

3. Tim Mills, Physics at a Glance Full Physics Content of the New GCSE, Manson Publishing, London, 2008, 1, https://doi.org/10.1201/9781840765434

4. Peter H. Gleick and Michael Cohen, The World's Water, Oakland CA: Pacific Institute, 2018

*Supplementary reading*

1. Mircea S. Rogalski, Stuart B. Palmer, Solid State Physics, CRC Press, London, 2000, https://doi.org/10.1201/9781482283037

2. James Fargo Balliett, Oceans Environmental Issues, Global Perspectives, Routledge Taylor & Francis Group, London & New York, 2010, https://doi.org/10.4324/9781315702049

3. Ben Rogers, The Big Ideas in Physics and How to Teach Them, Routledge, Taylor & Francis Group, London, 2018, https://doi.org/10.4324/9781315305431