STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Fluid Mechanics II		**1010102211010130182**

Field of study	Profile of study (general academic, practical)	Year /Semester
Environmental Engineering Second-cycle	**(brak)**	**1 / 1**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Water Supply, Water and Soil Protection	**-**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
Second-cycle studies	**full-time**

No. of hours				No. of credits
Lecture: **30**	Classes: **15**	Laboratory: **15**	Project/seminars: **-**	**6**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
(brak)	**(brak)**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**6 100%**
Technical sciences	**6 100%**

Responsible for subject / lecturer:

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Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	The scope of scientific knowledge (geography, biology, chemistry, physics) at the level of engineering studies and knowledge of the subject on the basic issues of physical-chemical water treatment and water pollution and waste from literature, databases and other carefully selected sources.
2	**Skills**	A student identifies and describes the limiting factors in the aquatic environment. He/She is able to distinguish and characterize aquatic ecosystems. He/She is able to identify the causes and effects of various aquatic pollutants and their impact on human health.
3	**Social competencies**	Awareness of the need for the continuous updating and supplementing knowledge and skills

Assumptions and objectives of the course:

-passing thorough knowledge of the chemistry of water and wastewater, chemical and physical processes occurring in aquatic environment, the basis of technical and legal framework for the prevention, formation and reduction of water pollution

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. . A student has knowledge about water as a basic component of the environment. He knows the natural distribution of inland waters. He/She knows the effect of water constituents on the biochemical processes of the environment - [[K_W03, K_W05]]

2. A student has knowledge of the technical methods of pollution prevention and reduction of pollution of both water and wastewater. He/She knows the sources and types of pollution of natural waters and the impact of water pollution on aquatic life - [[K_W03, K_W07]]

3. A student knows short and long term processes occuring in the aquatic environment, he/she has knowledge of the biogeochemical cycles in aquatic environments - [[K_W03, K_W05,]]

4. A student has knowledge of the wastewater and sewage sludge as pollutants. He/She knows the specific organic and mineral substances present in wastewater and their impact on the environment and their effects on living organisms - [[K_W03, K_W07, K_W04]]

5. A student knows how to implement water protection and wastewater treatment policy.He/She knows the legal basis for the protection of the environment and environmental services organization - [[K_W02, K_W03, K_W05, K_W08]]

Skills:

1. . A student can obtain information about the degree water of contamination and wastewater load, from literature, databases and other carefully selected sources - [[K_U01]]

2. A student can make mathematical calculations under the laws of chemistry and physics for the test water or sewage - [[K_U01, K_U04,]]

3. . A student is able to apply the norms and standards for assessing the quality of water and wastewater in practice - [[K_U01, K_U05 K_U08, K_U09,]]

Social competencies:

1. A student understands the need for teamwork in solving theoretical and practical problems. - [[K_K03, K_K04]]

2. A student is aware of the need to verify the legal aspects related to the protection of water and wastewater treatment - [[K_K05]]

3. A student sees the need for systematic deepening and broadening his/her competence - [[K_K01]]

Assessment methods of study outcomes

-Lecture

- A written test after the lectures hale finished, the test will last foe 90 minutes,

-Individual discussion possible after the results of a written test.

Tutorials

2 mini-written tests during the semester;

1 written assignment test (finall);

Continuous assessment for each classes (rewarded activity)

Laboratory

- each laboratory practice will be preceded by an entrace exam that will check students? readiness to complete an experiment

- written assignment test (final)

Bonus points for activities in the classroom, and in particular for:

signaling errors and ambiguities to the lecturer;

discussion and participation in a lecture

help to improve teaching materials;

identifying opportunities to improve the educational process.

Course description

- The role of water in the formation of the Earth's climate. Terrestrial water cycle. Water resources in Poland.

- Construction of a water molecule, dipole moment, hydrogen bonding. Physical states of water, the structure of liquid water, steam and ice. Phase diagram of water, the phenomena associated with phase transitions.

- Physico-chemical analysis of natural ingredients and impurities comprising water and sewage.

- The physical properties of water: dielectric constant, specific heat, thermal conductivity, surface tension, conductivity, absorption of light radiation, the solubility of gases and liquids. The density of water and related phenomena. The chemical properties of water: dissociation, the ion product, reaction, the isotope.

- Water enrichment with minerals: chemical composition and structure of minerals, the physical and chemical soil weathering processes.

- The role of ion exchange in shaping the composition of natural waters. Aquatic dispersions.

- Evolution of the composition of water from precipitation to groundwater.

- Classification of natural waters by the ionic composition and degree of mineralization. Carbon dioxide. Carbonate-calcium balance. Basic indicators of the ionic composition of the water

- Eutrophication of waters. Nitrogenous compounds as indicators of water pollution. Heavy metals in water and their toxic effects in the water. Natural organic compounds in water.

- Water pollution by urban and industrial wastewater. Contamination of oil and its derivatives. Contamination of synthetic organic compounds: phenols, surfactants, pesticides, polycyclic aromatic hydrocarbons.

- By-products of water disinfection . Radioactive pollution. Estimating health risks. Standards of water quality and water treatment.

Basic bibliography:

1. Mitosek M., Mechanika płynów w inżynierii i ochronie środowiska. Warszawa, PWN 2001
2. Orzechowski Z., Prywer J., Zarzycki R., Mechanika płynów w inżynierii środowiska. Wyd. 2 zmienione. Warszawa, WNT 2001
3. Jeżowiecka-Kabsch K., Szewczyk H., Mechanika płynów. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2001
4. Mitosek M., Matlak M., Kodura A., Zbiór zadań z hydrauliki dla inżynierii i ochrony środowiska. Oficyna wydawnicza Politechniki Warszawskiej, Warszawa 2004
5. Orzechowski Z., Prywer J., Zarzycki R., Zadania z mechanika płynów w inżynierii środowiska. Warszawa, WNT 2001
6. Bogusławski L. (Red.), Ćwiczenia laboratoryjne z mechaniki płynów. Wydawnictwo Politechniki Poznańskiej, Poznań 1999
7. Niełacny M., Ćwiczenia laboratoryjne z mechaniki płynów. Wydawnictwo Politechniki Poznańskiej, Poznań 1996

Additional bibliography:

1. Munson B.R., Young D.F., Okiishi T.H., Fundamentals of Fluid Mechanics (4rd. Ed.). John Wiley and Sons Inc., New York 2002
2. White F.M., Fluid Mechanics. McGrawHill Book Company. 5th Int. Ed. Boston 2003

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	30
2. Participation in auditorium exercises	15
3. Laboratory classes	30
4. Participation in consultations relating to the implementation of the tutorials	3
5. Preparing to the final exam of tutorials	20
6. Preparation for the exam and the presence in the exam	30
7. Preparing for laboratory exercises and the final exams	25

Student's workload

Source of workload	hours	ECTS
Total workload	153	6
Contact hours	78	3
Practical activities	75	2