STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Water Supply Systems		**1010102211010130356**
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	**Polish**	**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: **30**	Laboratory: **-**	Project/seminars: **15**	**5**

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	**5 100%**
Technical sciences	**5 100%**

Responsible for subject / lecturer:

Tomasz Schiller
email: tomasz.schiller@put.poznan.pl
tel. 616652078
Faculty of Civil and Environmental Engineering
ul. Piotrowo 5 60-965 Poznań

Responsible for subject / lecturer:

dr inż. Alicja Bałut
email: alicja.balut@put.poznan.pl
tel. 616652438
Faculty of Civil and Environmental Engineering
ul. Piotrowo 5 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge acquired within courses delivered earlier during First-cycle and Second-cycle studies Fluid mechanics, Water supply, Mathematics
2	**Skills**	Use of knowledge obtained and skills acquired as part of the subjects mentioned above, especially Water supply. Self-education ability
3	**Social competencies**	Awareness of the need to constantly update and supplement knowledge and skills

Assumptions and objectives of the course:

Widening and deepening of knowledge and skills acquired in the first-cycle studies required for solution of complex engineering problems concerning water supply

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

Knowledge:

1. Student knows water supply systems calculation methods - [K2_W01, K2_W03]
2. Student knows methods used in water supply systems modelling - [K2_W01, K2_W05, K2_W07]
3. Student knows hydraulics models calibration criteria and an influence of changes in the parameters on obtained results - [K2_W01, K2_W07]
4. Student knows a GIS basics needed for water supply systems modelling - [K2_W01, K2_W05]

Skills:

1. Student can prepare performance characteristics of selected sources of water supply systems - [K2_U05, K2_U09, K2_U10]
2. Student can perform calculation of selected hydraulic power systems - [K2_U05, K2_U09, K2_U10]
3. Student is able to build input data basic structure necessary to build computer model of water distribution system - [K2_U01, K2_U05, K2_U07, K2_U08, K2_U09, K2_U10]
4. Student can identify parameters that may cause adverse effects in water distribution systems - [K2_U01, K2_U05, K2_U07, K2_U08, K2_U09, K2_U10]
5. Student understands the need to check and verify the obtained results - [K2_U01, K2_U08, K2_U10, K2_U15]

Social competencies:

1. Student sees the need for systematic increasing his skills and competences - [K2_K01]
2. Student understands the need for teamwork in solving theoretical and practical problems - [K2_K01, K2_K03, K2_K04]
3. Student understands the need to check and verify obtained results - [K2_K02, K2_K05]

Assessment methods of study outcomes

Final exam:

One part written exam (80min). Its timing is confirmed in the first of week of the semester. Exam consists of a few open questions. The goal is to assess knowledge gained during lectures (learning effect W1 to W6).

Range of scale: NB-absent; 2(?23 points); 2,5 (23,5 points); 3 (24-28 points); 3,5 (29-33 points);4,0 (34-38 points); 4,5 (39-43 points); 5 (44-46 points).

Practical exercises :

Part 1: .?Get started with ArcMap?- organize data base to create and print maps to share in file? in the ArcGIS software.

Scale range: <80% (2), 80%(3), 85%(3+), 90%(4),95%(4+),100%(5).

Part 2: ?Get started with ArcGIS Online? ? the goal is to create a link to the map with pop-ups and share the map as a web app based on ArcGIS. (learning effect U01,U09, U10).

Scale range: <80% (2), 80% (3), 85% (3+), 90% (4),95% (4+),100% (5).

Part 3: 80 mins written test that includes a dozen questions that?s aim is to test students? practical knowledge of ArcGIS. Input data for carrying out tasks are uploaded by the instructor during the first 10 minutes of the exercise (efekty kształcenia U01,U09,U10).

Scale range: <76%(2,5), 81%(3), 88%(3+), 92%(4), 96%(4+), 100%(5).

Part 4: Tutorials: evaluation of presentation prepared in subgroups, test

Choice of one of subjects suggested by the lecturer, delivery of a presentation and its defence ? work done in subgroups (learning effect: W5, W6, K1, K2, U1, U2, U4).

Scale range: (NB; 2,0; 2,5; 3,0; 3,5; 4,0; 4,5; 5,0).

Part 5: 40min written examination test that includes a dozen multiple choice and two open questions.

Continuous assessment during classes ? rewards for activity (learning effect K1).

Project exercises:

Practical exercises: evaluation of advanced projects (learning effect U01, U02, U03, U04, U05, K1, K2, K4).

Continuous assessment of project completion at each class ? rewards for activity (learning effect K1).

Range of scale: (NB;2,0;2,5;3,0;3,5;4,0;4,5;5,0).

Course description

Lectures:

1. GIS basics that concern water distribution systems modelling.
2. Allocation of water demand points integrated with GIS system points. Spatial data models.
3. Development of informatics tools for modelling water distribution systems. Modelling with an application of computer programs. Stages of model construction.
4. Data acquisition methods for construction of water supply network models. Use of a computer model to analyse and evaluate a water supply system.
5. Calibration, verification and validation methods of hydraulic water distribution systems models.
6. Water intakes. Types of shots and ways of capturing surface water and underground water.
7. Numeric terrain models. Create spatial-descriptive queries in SQL
8. Piping Systems Calculation (Series and Parrallel).
9. Tasks carried out by measuring equipment for monitoring of water supply networks.

Exercises topics:

Part 1,2,3:

1. Types of spatial data and methods of their acquiry.
2. Activities undertaken at vector and raster data. Analysis of relationshipships between them.
3. Basic theory of spatial-descriptive queries (SQL language).
4. Analysis of basic projects in ArcGIS software.

Part 4,5:

1. Management of water quality in water supply systems and risk analysis.
2. Secondary water contamination in water systems.
3. Modelling of changes of quality.

Exercise topics (project):

1. Calculation of water demand for a given customer group.
2. Design a water network (location, diameter).
3. Design a pump station (hydraulic and efficiency curves).
4. Control theory-based simulation methods.
5. Calculation and analysis variety of the models in hydraulic model based on EPANET 2.0.14 software.

Basic bibliography:

1. Gabryszewski T., Wodociągi, PWN, Wrocław 1983
2. Grabarczyk Cz., Hydraulika urządzeń wodociągowych?, Warszawa, WNT, 2015 (tom1 i 2).
3. Mielcarzewicz E., Obliczanie systemów zaopatrzenia w wodę, Arkady, Warszawa 2001
4. Kwietniewski M. i inni, Projektowanie elementów systemu zaopatrzenia w wodę, Wydawnictwo Politechniki Warszawskiej, Warszawa 1998
5. Kwietniewski M., GIS w wodociągach i kanalizacji, PWN, Warszawa, 2008

Additional bibliography:

1. Rossman L. A., EPANET 2 Users Manual, US EPA, 2000
2. Boulos P.F. , Lansey K.E., Comprehensive Water Distribution Systems analysis Handbook for engineers and planners, MWH Soft., USA, 2006
3. Cesario L., Modeling, Analysis and design of Water Distribution Systems, AWWA, USA, 1995
4. Manual of Water Supply Practices M32, Computer Modeling of Water Distribution Systems, AWWA, USA, 2005
5. Reference Guide for Utilities, Water Distribution System Analysis. Field Studies, Modeling and Management, US EPA, USA, 2005
6. Szuster-Janiaczyk A, Zarządzanie jakością wody w systemach wodociągowych, XIX Krajowa, VII międzynarodowa konferencja naukowo-techniczna : zaopatrzenie w wodę, jakość i ochrona wód, Zakopane, 18-21 czerwca 2006 r. / red. Andrzej Królikowski, Marek M. Sozański / PZIiTS Oddz. Wielkopolski [i in.] [org.]. - Poznań : PZIiTS Oddz. Wielkopolski. - T. 1, 2006. - S. 863-883.
7. Urbaniak A., Bałut A., Brodziak R., Bylka J., Technologie IT w realizacji idei zrównoważonego rozwoju w systemach zaopatrzenia w wodę, Instal, nr 10, str.76-79, 2015r.
8. Bałut A, Bylka J., Modele komputerowe jako narzędzia wspomagania w procesie zarządzania układami rozprowadzającymi wodę w systemach wodociągowych?, Instal, nr 12, str.91-96, 2013r.

Result of average student's workload

Activity	Time (working hours)

1. Participation in lectures	30
2. Participation in excersises	30
3. Participation in practical exercises	15
4. Participation in consultations related to exercises	3
5. Preparation for the exercises	7
6. Preparation for the practical exercises	14
7. Preparation for the exam	24
8. Presence at the exam	2

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	125	5
Contact hours	83	3
Practical activities	20	1