COURSE DESCRIPTION CARD - SYLLABUS

Course name
Water supply I [N1IŚrod2>ZwWI]

Course

Field of study
Environmental Engineering

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
20

Laboratory classes
0

Other
0

Tutorials
10

Projects/seminars
0

Number of credit points

3,00

Coordinators

dr inż. Agnieszka Szuster-Janiaczyk
agnieszka.szuster-janiaczyk@put.poznan.pl

Lecturers

Prerequisites

Fluid mechanics: knowledge of physical quantities characterising liquids; units; the basic notions and principles describing the flow of water in conduits; knowledge of the methods used to measure such quantities. Knowledge of equations describing the phenomena; understanding the causes of water hummer and cavitation and knowledge of the principles used to describe them. Mathematics: knowledge of the formulation basics and the methods of solving of systems of algebraic linear and non-linear equations. Knowledge of the basics of mathematical optimization. Determining extreme values of functions. Solving problems with hydraulic calculations for pipelines connected with reservoirs and pumps; solving algebraic, linear and non-linear equations and systems of equations; measurements of hydraulic parameters; selection of measuring devices. Awareness of the need to continuously update and upgrade the knowledge and skills.

Course objective

Conveying the basic knowledge and skills in planning, designing and operation of process equipment and technological operations associated with water abstraction, storage and transport from the intakes to water treatment plants and from water treatment plants to service lines supplying household water distribution systems.

Course-related learning outcomes

Knowledge:
1. The student has knowledge about the structure of systems for water abstraction and transport to water distribution and supply systems. The student knows the functions, types and properties of the equipment making up process assemblies in the systems. The student knows the functions, types and characteristics of the devices in the technological systems .
2. The student knows the basic techniques and tools necessary to solve engineering problems in the scope of structure and maintenance of equipment employed in water abstraction and distribution systems. The student knows the principles of designing vertical wells, including pump and siphon systems transporting water from vertical wells to the water treatment plants, the rules of selecting and dimensioning equipment for the system.

Skills:
1. The student can identify the properties, analyse the operating conditions and assess the technical condition of the technological systems used for water abstraction.
2. The student can formulate and solve problems involving selection and dimensioning of the system components during the process of planning, designing, building, renovating and maintaining the systems.

Social competences:
1. The student understands the need for teamwork in the solving of theoretical and practical problems.
2. The student is aware of the significance of problems associated with water management optimization
3. The student recognizes the need for systematic enhancement of knowledge and development of competences and skills.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:
The lecture ends with a written test consisting of 25 questions, which are a combination of open, closed and test questions. There are also questions on the test, which check the knowledge provided in the auditorium exercises. Duration of the pass: 60 minutes. The condition for passing the course is to obtain at least 50% of the points on the final pass.
Auditorium exercises:
Accounting exercise reports. The condition for passing the course is to obtain at least 50% of the points from the final report.

Programme content

Lecture:
1. Introduction. Organizational matters - the rules of passing the course, available literature. Definition of a water supply system. Historical view. Occurrence of water in nature - underground waters, surface waters, spring waters. World and Polish drinking water resources. Access to water as a source of global water conflicts. Water crises.
2. Basic legal acts regulating the operation of water supply systems (SZwW) in Europe and Poland. Tasks of the water supply system and its components. Functions and structure of the water supply system.
3. Types and characteristics of groundwater. Movement of water in the aquifer. Groundwater intakes. Intake of underground water by means of drains and dug wells.
4. Intake of water by means of drilled wells. Schemes of water inflow to wells with a free and pressure water table. Well performance calculations. Group intakes using a set of drilled wells - number, spacing and efficiency of wells. Ways of drawing water from drilled wells - pumps, siphons. Hydraulic analysis of well cooperation with siphon and pump systems. Devices, calculations, construction and design principles. Execution of a drilled well. Determining water resources. Hydrogeological research.14. Final test
5. Infiltration water intakes. Groundwater enrichment - natural and artificial infiltration. Characteristics of infiltration waters. Filter ponds. Intake of underground water by means of radial wells. Devices, calculations, construction and principles of their design. Calculation of the efficiency of infiltration wells.
6. Surface water intakes. Water intake protection zones. Types and characteristics of surface waters. Types of surface water intakes - flowing waters, stagnant waters, rainwater.
7. Surface water intake - objects and devices. Determining water resources. Hydrological research.

Water intake protection zones
8. Spatial development plans. Planning, programming of water supply systems. Groups of water recipients. Basic quantities characterizing the demand for water. Indicators of unit water consumption. Coefficients of non-uniformity of water distribution. Hourly distribution of water demand. Principles of determining the demand for water. Methods of calculating and forecasting water demand. Fire water requirements. The concept of "water trace".
9. Designing water supply networks and conduits. Types of water pipes - transit, main and distribution. Layout of water pipes. Network routing. Classification of systems and their schemes. Characteristics of SZwW systems and elements. Examples of spatial solutions - structures of systems.
10. Hydraulic calculations of water supply systems of various complexity. Basics of hydraulic calculations. flow resistance. Determination of computational flows. Partial surfaces, sectional partitions, nodal partitions.
11. Calculations of transit, main and distribution lines. Calculation of branch and ring networks. Determining the diameters of water pipes.
12. Pressure distribution in the water supply network. Minimum, maximum pressure. Determining the distribution of pressure in the water supply network. Pressure line graph. Zoning of the water supply network.
13. Transportation of water. Gravity and pump transport. Pump classification. Basic operating parameters of centrifugal pumps. Pump applicability area. Cavitation phenomenon. Pump systems. Theoretical basis of pump selection. Pump cooperation. Methods of regulating the working parameters of pumps. Division of pumping stations - groups of primary and reserve pumps . The principle of operation of hydrophores. The phenomenon of water hammer and methods of its suppression.
14. Final test
15. Improvement of the final test
Tutorials exercises: Calculating the performance of wells with a free and pressure water table - calculating exercises.
1. Introduction. Issue data for calculations.
2. Determination of the filtration coefficient for the aquifer.
3. Granulation curve, test pumping method.
4. Selection of filter and protective layers in the form of backfills.
5. Calculation of the theoretical
6. Calculation of actual well performance.
7. Cooperation of the well team. Calculation of the depression funnel range. Calculation of the efficiency of cooperating wells.

Course topics

none

Teaching methods

Learning methods:
Lecture: Lecture using multimedia presentations, combined with discussion with the listeners.
Auditing exercises: practice method using multimedia presentation.

Bibliography

Basic:
1. Gabryszewski T., Wodociągi, Arkady, Warszawa, 1983
2. Suligowski Z., Zaopatrzenie w wodę, Wydawnictwo Seidel-Przywecki sp. z o.o., 2014
3. Mielcarzewicz E., Obliczanie systemów zaopatrzenia w wodę, Arkady, Warszawa 2001.
4. Knapik K., Bajer J., Wodociągi, Politechnika Krakowska, 2011

Additional:
1. Lyp B., Strefy ochrony ujęć wód podziemnych, Wydawnictwo Seidel-Przywecki sp. z o.o., 2018
2. Kwietniewski M. i inni, Projektowanie elementów systemu zaopatrzenia w wodę, Wydawnictwo Politechniki Warszawskiej, Warszawa 1998
3. Pociask-Karteczka J., Zlewnia, właściwości i procesy, Wydawnictwo Uniwersytetu Jagiellońskiego, 2006

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	2,00