COURSE DESCRIPTION CARD - SYLLABUS

Course name
Water supply

Course

Field of study
Environmental Engineering

Year/Semester
2 / 3

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes

Other (e.g. online)

Tutorials
15

Projects/seminars
0

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:

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.

3. The student knows the methods of programming development, designing and operating water supply systems and equipment items of which such systems are composed. Student knows the standards characterising the level of services and the equipment maintenance standards.

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

3. The student can plan and carry out experiments, including simulations of the operating conditions of pipelines transporting water from water intakes and in water supply networks, including their interaction with other components of the water supply systems.

4. The student can formulate and solve engineering problems, taking into account the system aspects and the economic and legal factors of planning, designing and maintaining equipment.

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 can identify the social and political factors which may have an impact on the decisions made in the process of water supply systems management.

4. 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:

Written exam, consisting of 25 questions, which are a combination of open, closed and test questions. Duration: 60 minutes. Maximum number of points to get: 100 points.Grading scale:

0 ÷ 49.5 - (2.0)

50 ÷ 60 - (3.0)

60,5 ÷ 70 -(3,5)

70,5 - 80 -(4,0)

80,5 - 90 - (4,5)

90,5 ÷ 100 - (5,0)

Learning effects: W01, W02, W03, W5, W06, W07

Tutorial exercises:

Reports on tutorials and final test consisting of two calculation tasks and two open questions. Duration 90 minutes. Maximum number of points to get: 40 points.

Grading scale:

0 ÷ 19.5 - (2.0)

20 ÷ 24 - 3.0)

24,5 - 28 -(3,5)

28,5 - 32 - (4,0)

32,5 ÷ 36 - (4,5)

36,5 ÷ 40- (5,0)

Learning effects: [W 04, W08, W09, U02, U04, K03)

Learning methods:

Lecture: Lecture using multimedia presentations, combined with discussion with the listeners.

Auditing exercises: practice method using multimedia presentation.

Design exercises: a design method using multimedia presentations

Programme content

Lecture:

1. Introduction. Organizational matters - credit rules, available literature. Definition of water supply system. Historical view. Water supply tasks and its components. Functions and structure of the water supply system. Occurrence of water in nature -ground waters, surface waters, spring waters. World and Polish drinking water resources. Basic legal acts regulating the operation of water supply systems (SZwW) in Europe and Poland.

2. Groundwater intakes. Types and characteristics of groundwater. Groundwater movement. Underground water treatment with drains, dug wells and drilled wells. Calculation of well performance. Group shots using a set of drilled wells - number, spacing and performance of wells. Ways of drawing water from drilled wells - pumps, siphons. Hydraulic analysis of well cooperation with siphon and pump systems. Equipment, calculations, construction and design principles. Execution of a drilled well. Determining water resources. Hydrogeological research.

3. Intakes of infiltration waters. Groundwater enrichment - natural and artificial filtration. Characteristics of infiltration waters. Filter ponds. Underground water intake by means of radial wells. Devices, calculations, construction and design principles. Calculation of the efficiency of infiltration wells.

4. Surface water intakes. Protective covers for water intakes. Types and characteristics of surface waters. Types of surface water intakes - flowing water, standing water, rainwater. Objects and devices - construction and design principles. Determining water resources. Hydrological studies. Protection zones for water intakes

5. Methods for calculating and forecasting water demand. Planning, programming water supply systems. Spatial development plans. Rules for determining water demand. Water recipient groups. Indicators of specific water consumption. Water unevenness coefficients. Basic quantities characterizing the demand for water. Hourly distribution of water demand. Fire water demand.

6. Water collection. Water tanks. The role and importance of reservoirs in water supply systems. Classification of water tanks. Calculation of tank capacity. Tank equipment. Location rules, design, operation. Operation and hygiene of water supply tanks. Replacement tank devices.

7. Designing of water supply networks and pipes. Types of water-transit, main and distribution pipes. Water supply system. Network routing. System classification and their schemes. Characteristics of SZwW systems and components. Examples of spatial solutions - structure of systems.

8. Determination of calculation flows. Diameter selection Partial surfaces, sectional partitions, nodal partitions. Determining the diameter of water pipes.

9. Hydraulic calculations of water supply systems of varying complexity. Basics of hydraulic calculations. Flow resistance. Calculations of transit, main and distribution cables. Calculation of branched and ring networks.

10. Pressure distribution in the water supply network. Minimum and maximum pressure. Determining the pressure distribution in the water supply network. Pressure line graph. Zoning the water supply network.

11. Water transport. Gravity and pump transport. Pump classification. Basic working parameters of centrifugal pumps. Area of applicability of pumps. The phenomenon of cavitation. Pump systems. Theoretical basics of pump selection. Pump cooperation. Methods of adjusting pump operating parameters. Division of pumping stations - primary and reserve pump sets. The principle of operation of hydrophores. Phenomenon of hydraulic impact.

12. Materials and utilities for water pipes. Water pipe series. Pros and cons of individual material solutions. Water supply equipment - devices: flow regulation, dredging, safety, measuring. Other water supply facilities. Water wells. Selection and principle of arranging water supply pipe utilities.

12. Details of cable and network design. Construction of water pipes. Cable layout in the street. Water pipe profiles. Passage of cables through obstacles. Mapping the route. Execution and protection of the excavation. Cable laying and assembly. Leak test. Finishing works.

13. Renewal and modernization of water supply networks and devices. Water supply network inspection - possibilities and devices used. Excavation and trenchless technologies in the renovation of the water supply network. Replacement of the water supply network.

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. Granulation curve, test pumping method.

3. Selection of filter and protective layers in the form of backfills.

4. Calculation of the theoretical and actual well performance.

5. Cooperation of the well team. Calculation of the depression funnel range. Calculation of the efficiency of cooperating wells.

6. Final test.

7. Improvement of the final test

Teaching methods

Lecture: Lecture using multimedia presentations, combined with discussion with the listeners.

Tutorial 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	3,0
Classes requiring direct contact with the teacher	45	2,0
Student's own work (literature studies, preparation for tutorials, preparation for tests) [1]	30	1,0

[1] delete or add other activities as appropriate