COURSE DESCRIPTION CARD - SYLLABUS

Course name
Water supply II [N1IŚrod1>ZwWII]

Course

Field of study
Environmental Engineering

Year/Semester
3/6

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
10

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
20

Number of credit points

4,00

Coordinators

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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 of the structure of water intake and distribution systems in water supply systems, knows the functions, types and features of devices constituting technological systems in the system.
2. The student knows the basic techniques and tools needed to solve engineering tasks in the field of construction and maintenance of equipment in water intake and distribution systems. The student knows the principles of designing vertical wells. Pump and siphon systems transporting water from vertical wells to the treatment station, principles of selection and dimensioning of devices for these systems.
3. The student knows the methods of programming the development, design and operation of water supply systems and the devices that are their elements. The student knows the standards characterizing the level of service, level of equipment maintenance. The student knows the next phases in the process of planning, design and construction of water supply systems and the requirements for the necessary project documentation.
4. The student has knowledge about the complexity of the issues of operation of water supply systems. Monitoring of hydaraululative and quality parameters. Knows what the WHO Water Safety Plan is. He knows the concept of critical points in the system and knows the tools for estimating the risk of adverse events in SZwW.

Skills:
1. Student is able to identify features, analyze working conditions and assess the technical condition of exploited technological systems used for water intake and distribution.
2. Student is able to formulate and solve tasks of selection and dimensioning of system components as part of their planning, design, construction, modernization and maintenance.
3. Student is able to plan and conduct experiments, including simulations, of working conditions of pipelines transporting water on intakes and in water supply networks, their cooperation with other systems constituting the water supply system.
4. Student, formulating and solving engineering tasks, is able to see systemic aspects, economic and legal conditions of planning, designing and maintenance of devices.

Social competences:
1. The student understands the need for teamwork in solving theoretical and practical problems.
2. Student realizes the importance of tasks related to optimal water management.
3. Student is able to identify socio-political conditions that may affect decisions taken in the management of water supply systems.
4. Student recognizes the need for systematic deepening of knowledge and extension of their competences.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:
The lecture ends with a written exam consisting of 25 questions, which are a combination of open, closed and test questions. The exam also includes questions that test the knowledge provided in the project exercises. Duration: 60 minutes. The condition for passing the course is to obtain at least 50% of the points on the final pass.
Project excercises:
Checking progress in class, which is documented by entries in the consultation card.
Completion based on the completed post-project exercise - maximum number of points: 60 points
Credit on the basis of a 3-stage design exercise.
Project exercises are passed after obtaining at least 50% of the possible points from the project, but not less than 30% from each of the 3 stages.

Programme content

Lecture:
1. Water storage - water tanks. The role and importance of water tanks in water supply systems. Classification of water tanks. Calculation of capacity and dimensioning of tanks. Construction and equipment of tanks. Location rules and design. Operation and hygiene of water tanks. Replacement tank

devices.
2. Materials used to build a water supply network. Advantages and disadvantages of individual material solutions. Pipe ranges available. Reinforcement of water supply lines - devices: for regulating the flow, drawing, securing, measuring. Other water supply facilities. Water wells. Selection and arrangement of water supply conduit armament. Wire and network design details.
3. Construction of the water supply network. Layout of wires in the street. Water pipe profiles. Passage of wires through obstacles. Layout of the route. Excavation and protection. Laying and assembly of the cable. Tightness test. Finishing works. Aging, renovation and replacement of the water supply system. Inspection of the water supply network - possibilities and devices used. Excavation and trenchless technologies in the renovation of the water supply system. Replacement of the water supply network.
4. Operation of water distribution systems. Basic principles of exploitation of water intakes, networks and pumping stations. Flushing the water supply network - types of flushing, required hydraulic parameters. Network failure. Water supply reliability indicators.
5. Monitoring of hydraulic parameters of network operation - measuring instruments. Water quality monitoring. Collecting and archiving data. Remote data reading and analysis systems. Water quality supervision. Types of water quality monitoring. Online monitoring and taken water samples from the network. Measuring instruments. Scope, frequency and location of water quality monitoring points. IT support for the operation of the water supply network. SCADA system.
6. Computer aided design and operation of water transport systems. Database. Spatial information systems. Computer modeling of water distribution systems. Mathematical basis of modeling of hydraulic and qualitative parameters. Stages of construction of hydraulic models of water supply networks. Modeling of individual hydraulic devices. Methods of verification and calibration of hydraulic models.
7. Management of processes shaping the water quality in water supply systems. Water Safety Plans. Factors shaping water quality in water supply system. Processes of secondary water contamination in water supply systems. Prevention of secondary water contamination processes. Determination of critical points in the system. Estimating the risk of adverse events in water demand systems. Water Safety Plans acc. WHO (Water Safety Plans).
Project exercises: Water supply network project for a city with balanced functions.
1. The issue of thematic cards. Discussion of how to develop a spatial development plan. Data acceptance for the project.
2. Calculation of water demand.
3. Hourly distribution of water demand.
4. Dimensioning of water tanks.
5. Consultaion. Passing stage 1 of the project.
6. Routing the water supply network.
7. Determination of nodal partitions.
8. Development of calculation schemes for maximum water demand and fire demand.
9. Development of calculation scheme for hour of water transit
10. Pre-selection of water pipe diameters
11. Consultaion. Passing stage 2 of the project.
12. Hydraulic calculations of the water supply network by the Cross-Łobaczew method.
13. Correction of pre-selected diameters.
14. Development of the pressure line graph.
15. Selection of pumps. Consultaion. Passing stage 3 of the project.

Teaching methods

Lecture: Lecture using multimedia presentations, combined with discussion with the listeners.
Project exercises: practice design 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. Clark R., Grayman W., Modeling Water Quality in Drinking Water Distribution Systems, AWWA, 1998

2. Guidlines for Drinking-water Quality, wydanie 4, WHO 2011
3. Lyp B., Strefy ochrony ujęć wód podziemnych, Wydawnictwo Seidel-Przywecki sp. z o.o., 2018
4. Kwietniewski M. i inni, Projektowanie elementów systemu zaopatrzenia w wodę, Wydawnictwo Politechniki Warszawskiej, Warszawa 1998
5. Pociask-Karteczka J., Zlewnia, właściwości i procesy, Wydawnictwo Uniwersytetu Jagiellońskiego, 2006
6. Rak J., Tchórzewska-Cieślak B., Ryzyko w eksploatacji systemów zbiorowego zaopatrzenia w wodę, Wydawnictwo Seidel-Przywecki sp. z o.o., 2013
7. Kowalski D., Nowe metody opisu struktur sieci wodociągowych do rozwiązywaqnia problemów ich projektowania i eksploatacji, Monografia PAN, Lublin 2011
8. Szuster-Janiaczyk Agnieszka, 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

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