

(faculty stamp)

**COURSE DESCRIPTION**

<b>1) Course title:</b> Hydraulics of water distribution and wastewater discharge systems		<b>2) Course code:</b>		
<b>3) Validity of course description:</b> 2019/20				
<b>4) Mode of studies:</b> intramural studies				
<b>5) Level of studies:</b> MSc programme				
<b>6) Field of studies:</b> Environment Protection				
<b>7) Profile of studies:</b> general				
<b>8) Programme:</b> Water and Soil Protection Systems				
<b>9) Semester:</b> 2				
<b>10) Faculty teaching the course:</b> Institute of Water and Wastewater Engineering				
<b>11) Course instructor:</b> dr inż. Anita Zakrzewska				
<b>12) Course classification:</b> speciality course				
<b>13) Course status:</b> compulsory				
<b>14) Language of instruction:</b> English				
<b>15) Pre-requisite qualification:</b> basic knowledge of water supply systems and wastewater discharge systems				
<b>16) Course objectives:</b> The aim of a course is to provide the knowledge and practical basics of hydraulics for solving pipe network flow problems, designing and maintaining facilities using in water and sewage treatment plants.				
<b>17) Description of learning outcomes:</b>				
Nr	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
1.	Identifies and describes pumps and pipes connections, determines hydraulic characteristics and calculates basic hydraulic parameters.	test	lecture	K1A_W17 K1A_W21 K1A_U18
2.	Describes a water hammer phenomenon, calculates a sonic velocity and pressure rise in the pipe, proposes solution for preventing and reducing the effects of water hammer.	test	lecture	K1A_W17 K1A_W21 K1A_U18
3.	Distinguishes and classifies types of chemical reactors, flow patterns in reactors, knows the experimental methods for finding exit age distribution.	test	lecture	K1A_W09 K1A_W17 K1A_U08
4.	Solves pipe network problem (Hardy-Cross method), determines discharges and pressure in branched network, calculates pressure surge.	report	project	K1A_W04 K1A_U18 K1A_U19
5	Determines flow rate, total head, flow paths, distribution of water pressure along the dam base	report	project	K1A_W04 K1A_U12 K1A_U18 K1A_U19

**18) Teaching modes and hours**

Lecture	Classes	Laboratory	Project	Seminarium
15			15	

**19. Syllabus description:****Lecture:**

Closed conduit hydraulics (application of the conservation of mass and conservation of energy, head loss calculating). Design of a simple pipe system. Pumps in water distribution systems. Basic problems of pipe network flow: branched and looped systems, equivalent pipes for parallel and in series pipes. Solving pipe network flow problems. Storage in water distribution systems. The water hammer in water distribution systems. Surge protection. Sizing of open channels and close conduits partially filled. An introduction to reactor hydraulics and design. Mass balance and performance equations. Theoretical detention time. Tracer studies and the residence time distribution (RTD) for units operated under steady state conditions.

**Project:**

Solving looped network problem using Hardy-Cross method.

Solving three reservoir problem.

Water flow under the dam: flow rate, total head, flow paths, distribution of water pressure along the dam base.

Calculating the pressure surge during water hammer phenomenon

**20. Egzamination:** none**21. Primary source:**

Chadwick A., Morfett J.: Hydraulics in Civil and Environmental Engineering. E. & FN SPON, London, 1993.

Mielcarzewicz E. W.: Obliczanie systemów zaopatrzenia w wodę. Arkady, Warszawa, 2000.

J. Szarawara, J. Skrzypek, A. Gawdzik – Podstawy inżynierii reaktorów chemicznych. WN-T, Warszawa, 1991.

**22. Secondary source:**

Siwiec T., Soczewica A., Wróbel J.: Wybrane przykłady i zadania z wodociągów i kanalizacji. Wyd. Prywatnej Wyższej Szkoły Ochrony Środowiska. Radom 1998.

**23. Total workload required to achieve learning outcomes**

Lp.	Teaching mode	Contact hours / Student workload hours
1.	Lecture	15/30
2.	Classes	
3.	Laboratory	15/30
4.	Project	
5.	BA/MA Seminarium	
6.	Other	2/0
Total number of hours:		32/60

**24. Total hours:**

92

**25. Number of ECTS credits:**

3

**26. Number of ECTS credit allocated for contact hours:**

1

<b>27. Number of ECTS credit allocated for in-practice hours (laboratory, classes, projects):</b>	1
<b>28. Comments:</b>	

Approved:

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(date i instructors signature)

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(date, the Director of the Faculty Unit signature)