

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Systems of Water Treatment		Code 1010135221010130358
Field of study Enviromental Engineering Extramural Second-	Profile of study (general academic, practical) (brak)	Year /Semester 1 / 2
Elective path/specialty Water Suply, Water Soil Protection	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: Second-cycle studies	Form of study (full-time,part-time) part-time	
No. of hours Lecture: 30 Classes: - Laboratory: 10 Project/seminars: 15		No. of credits 6
Status of the course in the study program (Basic, major, other) (brak)		(university-wide, from another field) (brak)
Education areas and fields of science and art technical sciences Technical sciences		ECTS distribution (number and %) 6 100% 6 100%
Responsible for subject / lecturer: prof. dr hab. inż. Marek Sozański email: marek.sozanski@put.poznan.pl tel. 61 665 3662 Faculty of Civil and Environmental Engineering ul. Piotrowo 5 60-965 Poznań		Responsible for subject / lecturer: dr inż. Joanna Jeż-Walkowiak email: joanna.jez-walkowiak@put.poznan.pl tel. 61 665 3662 Faculty of Civil and Environmental Engineering ul. Piotrowo 5 60-965 Poznań
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	Student should have a basic knowledge about water technology, mathematics, chemistry, fluid mechanics and general knowledge from environmental engineering.
2	Skills	Student should be able to search valuable information and read research articles and reports with understanding. Student should be able to perform mathematical calculations, physical, chemical, mechanics of the fluids and calculation of equipment and facilities of water treatment plants.
3	Social competencies	Awareness to constantly update and supplement knowledge and skills.
Assumptions and objectives of the course: Knowledge of principles of design of processes and water treatment technological systems. Knowledge of possibilities and methods of intensification of treatment effectiveness. Skill of pilot research design and procedures at pre-design study of processes and objects of water treatment as well as ability of managing of design, investment and operation of water treatment plants.		
Study outcomes and reference to the educational results for a field of study		
Knowledge:		
1. Student has structured and theoretically founded knowledge of methods of water treatment. - [[K2_W03, K2_W04, K2_W07]		
2. Student has an ordered knowledge of design methods of basic technological processes used in the raw water treatment technology - [K2_W03, K2_W04, K2_W07]		
Skills:		
1. Student knows how to design raw water treatment plant. - [K2_U01, K2_U12, K2_U18]		
2. Student knows how to do the conception of processes for raw water treatment plant. - [K2_U01, K2_U12, K2_U18]		
Social competencies:		
1. Student understands the need for teamwork in solving theoretical and practical problems - [K2_K03]		
2. Student understands the different roles in teamwork and the need for information and knowledge exchange in a group work - [K2_K03, K2_K04]		
3. Student understands the need for a systematic deepening and broadening his/her competences - [K2_K01]		

Assessment methods of study outcomes		
Examination, defence of design.		
Course description		
Sources of anthropogenic contamination of natural water: surface water, groundwater. Classification of anthropogenic pollutants: toxicity, biodegradability. Water quality, mineralization, trophic. Experiment in water treatment designing, conception of treatment, pilot research, treatment train selection. Technological systems: effectiveness and reliability of treatment, multiple barrier treatment rule. Design of processes: sedimentation, coagulation with pH adjustment and adsorption, adsorptive resins, rapid and membrane filtration, chemical and catalytic oxidation, biological processes, disinfection, by-products, post disinfection reactivation of microorganism. Water quality in distribution systems: organoleptic quality, chemical stability of water, chemical and electrochemical corrosion, biological stability, biological corrosion, water conservation. Sludge management: mass and volume balance of backwash water and sludge, sedimentation, gravital thickening, mechanical dewatering, non-newtonian flow of sludge, drying, freezing, final sludge disposal and utilization.		
Basic bibliography:		
1. Apolinary L. Kowal, Maria Świdorska - Bróż, Oczyszczanie wody, PWN, Warszawa 2009		
2. Zbigniew Heidich i inni, Urządzenia do uzdatniania wody, zasady projektowania i przykłady obliczeń, Arkady, Warszawa 1987		
3. Hanna Majcherek, Podstawy hydromechaniki w inżynierii oczyszczania wody, wyd. Politechniki Poznańskiej, Poznań 2006		
4. Marek M. Sozański, Peter M. Huck, Badania doświadczalne w rozwoju Technologii Uzdatniania Wody, Monografie Komitetu Inżynierii Środowiska PAN, vol. 42, Lublin 2007		
Additional bibliography:		
1. Praca zbiorowa, Wodociągi i Kanalizacja w Polsce, tradycja i współczesność, Polska Fundacja Odnowy Zasobów Wodnych, Poznań ? Bydgoszcz 2002		
2. AWWA, Technical Editor F. W. Pontius, Water Quality and Treatment, McGraw ? Hill, Inc, New York. 1990		
3. MWH, Water Treatment Principles and Design (Secondo Editio, Revised by J. C. Crittenden, R. R. Trussell, D. W. Hanol, K. J. Howe and G. Tchobanoglous), John Wiley & Sons, Inc., Hoboken, NY, 2005.		
Result of average student's workload		
Activity	Time (working hours)	
1. Lectures	30	
2. Laboratory	10	
3. Project	15	
Student's workload		
Source of workload	hours	ECTS
Total workload	200	6
Contact hours	55	3
Practical activities	0	3