

Faculty of Civil Engineering / CIVIL ENGINEERING / WATER PROTECTION AND QUALITY

Course:	WATER PROTECTION AND QUALITY			
Course ID	Course status	Semester	ECTS credits	Lessons (Lessons+Exercises+Laboratory)
6640	Mandatory	1	4.5	3+1+0
Programs	CIVIL ENGINEERING			
Prerequisites	None.			
Aims	Review of issues of quality, protection and contamination of natural waters.			
Learning outcomes	After having passed the exam, students will be able to: 1. Explain components of water quality; 2. Calculate concentration of ions in water and express them in proper units; 3. Explain eutrophication process; 4. Explain transport process of contaminants in water; 5. Develop vulnerability maps, hazard and risk maps of groundwater contamination; 6. Determine limits of sanitary protection zones around watersources; 7. Calculate guaranteed ecological flow of waterflow; 8. Classify environmental impacts of hydrotechnical reservoirs.			
Lecturer / Teaching assistant	Doc. Dr. Milena Tadić - lecturer, Prof. Dr. Milan Radulović - lecturer			
Methodology	Lectures, exercises, consultations, homeworks, etc.			
Plan and program of work				
Preparing week	Preparation and registration of the semester			
I week lectures	Introduction. Basic characteristics of water. Solubility. Expression of solution concentration. Physical properties of water.			
I week exercises	Introduction. Basic characteristics of water. Solubility. Expression of solution concentration. Physical properties of water.			
II week lectures	Chemical composition of water. Soluble gases in water. Hydrochemical parameters (pH, Eh, stiffness, alkalinity, acidity, TDS, electrical conductivity). Macro and micro components of chemical composition. Organic matters in water (indicators BPK5, HPK, con			
II week exercises	Chemical composition of water. Soluble gases in water. Hydrochemical parameters (pH, Eh, stiffness, alkalinity, acidity, TDS, electrical conductivity). Macro and micro components of chemical composition. Organic matters in water (indicators BPK5, HPK, con			
III week lectures	Testing water quality. Laboratory equipment. Water sampling. Analyses of water samples. Accuracy check of chemical analyses. Water classification based on content of macro components.			
III week exercises	Testing water quality. Laboratory equipment. Water sampling. Analyses of water samples. Accuracy check of chemical analyses. Water classification based on content of macro components.			
IV week lectures	Graphic presentation of chemical composition. Calculation of mixture of waters with different origin. Hydrochemical indicators (saturation index with calcite (SIc) and dolomite (SI _d), hydrochemical coefficients, ratio Mg/Ca and salinity). Water aggressivi			
IV week exercises	Graphic presentation of chemical composition. Calculation of mixture of waters with different origin. Hydrochemical indicators (saturation index with calcite (SIc) and dolomite (SI _d), hydrochemical coefficients, ratio Mg/Ca and salinity). Water aggressivi			
V week lectures	Quality of aquatic ecosystems. Environmental terms. Level of ecological organization. Aquatic ecosystems. Horizontal and vertical zoning. Organisms in aquatic ecosystems. Food chain of aquatic ecosystems. Cycle of nitrogen and phosphor in nature.			
V week exercises	Quality of aquatic ecosystems. Environmental terms. Level of ecological organization. Aquatic ecosystems. Horizontal and vertical zoning. Organisms in aquatic ecosystems. Food chain of aquatic ecosystems. Cycle of nitrogen and phosphor in nature.			
VI week lectures	Eutrophication. Curve of change in dilute oxygen due to discharge of waste water into recipient. Calculation of pollutants concentration in recipient. Saprobity index. Quality components of aquatic ecosystems.			
VI week exercises	Eutrophication. Curve of change in dilute oxygen due to discharge of waste water into recipient. Calculation of pollutants concentration in recipient. Saprobity index. Quality components of aquatic ecosystems.			
VII week lectures	I TEST; I COLLOQUIUM			

VII week exercises	I TEST; I COLLOQUIUM
VIII week lectures	Contamination of natural waters. Sources of contamination (contaminants). Concentrated and loose contamination sources.
VIII week exercises	Contamination of natural waters. Sources of contamination (contaminants). Concentrated and loose contamination sources.
IX week lectures	Pollution matters (pollutants). Oil and oil derivatives. Detergents. Phenols. Pesticides. Mineral fertilizers. Heavy and toxic metals. Basic processes of transport and transformation of pollutants in water.
IX week exercises	Pollution matters (pollutants). Oil and oil derivatives. Detergents. Phenols. Pesticides. Mineral fertilizers. Heavy and toxic metals. Basic processes of transport and transformation of pollutants in water.
X week lectures	Contamination risk assessment for ground water. Vulnerability maps for ground water. Contamination hazard and risk maps for ground water.
X week exercises	Contamination risk assessment for ground water. Vulnerability maps for ground water. Contamination hazard and risk maps for ground water.
XI week lectures	Protection of drinking water sources. Determination and maintenance of zones and bands of sanitary protection of water sources. Marking the groundwater. Introducing national regulation on determination and maintenance of zones and bands of sanitary protection
XI week exercises	Protection of drinking water sources. Determination and maintenance of zones and bands of sanitary protection of water sources. Marking the groundwater. Introducing national regulation on determination and maintenance of zones and bands of sanitary protection
XII week lectures	Environmental impact assessment from hydrotechnical projects. Contents of elaboration on environmental assessment. Environmental impact assessment from hydrotechnical reservoirs-negative and positive impacts.
XII week exercises	Environmental impact assessment from hydrotechnical projects. Contents of elaboration on environmental assessment. Environmental impact assessment from hydrotechnical reservoirs-negative and positive impacts.
XIII week lectures	Legislation. Overview of national documents regulating water quality. Overview of EU and WHO (World Health Organization) documents on groundwater quality protection.
XIII week exercises	Legislation. Overview of national documents regulating water quality. Overview of EU and WHO (World Health Organization) documents on groundwater quality protection.
XIV week lectures	Repetition of lessons.
XIV week exercises	Repetition of lessons.
XV week lectures	II TEST; II COLLOQUIUM
XV week exercises	II TEST; II COLLOQUIUM
Student workload	Weekly 4.5 credits x 40/30 = 6 hours Total workload for the Subject 4.5x30 = 135 hours
Per week	Per semester
4.5 credits x 40/30=6 hours and 0 minuts 3 sat(a) theoretical classes 0 sat(a) practical classes 1 excercises 2 hour(s) i 0 minuts of independent work, including consultations	Classes and final exam: 6 hour(s) i 0 minuts x 16 =96 hour(s) i 0 minuts Necessary preparation before the beginning of the semester (administration, registration, certification): 6 hour(s) i 0 minuts x 2 =12 hour(s) i 0 minuts Total workload for the subject: 4.5 x 30=135 hour(s) Additional work for exam preparation in the preparing exam period, including taking the remedial exam from 0 to 30 hours (remaining time from the first two items to the total load for the item) 27 hour(s) i 0 minuts Workload structure: 96 hour(s) i 0 minuts (courses), 12 hour(s) i 0 minuts (preparation), 27 hour(s) i 0 minuts (additional work)
Student obligations	Attendance, preparation of graphical papers, taking the tests
Consultations	Monday 11.00-13.00
Literature	Literature: Dimitrijević N. (1991) Hidrohemija. Rudarsko-geološki fakultet. OOUR grupa za hidrogeologiju, Univerzitet u Beogradu, Beograd, p. 313 Vujasinović S., Matić I. (2009) Osnovi hidrogeoeкологије. Rudarsko-geološki

			fakultet, Univerzitet			
Examination methods			- Attendance to lectures and exercises: max 10 pt - Colloquiums: max 40 pt; - Final exam: max 50 pt; - Pass requires minimum 50 pt.			
Special remarks						
Comment			Further information about the Subject can be required from the lecturer, assistant, head of the study program and vice dean of academic affairs.			
Grade:	F	E	D	C	B	A
Number of points	less than 50 points	greater than or equal to 50 points and less than 60 points	greater than or equal to 60 points and less than 70 points	greater than or equal to 70 points and less than 80 points	greater than or equal to 80 points and less than 90 points	greater than or equal to 90 points