NAME OF THE COURSE	SURFACE WATER QUALITY MODELING					
Code		Year of study	2., III. semester			
Course teacher	Damir Jukić, PhD, Associate professor	Credits (ECTS)	5.0			
Associate teachers		Type of instruction (number of hours)	L	S	E	F
			30		15	
Status of the course	compulsory	Percentage of application of e-learning	/			

COURSE DESCRIPTION

Course objectives	- Acquainting students with basic physical, chemical and biological processes within surface water ecosystems. - Understanding processes of transport and assimilation of various types of pollution in surface waters. - Reviewing potential benefits, limitations, and pitfalls in application of water quality mathematical models.
Course enrolment requirements and entry competences required for the course	Undergraduate qualification (6th level of EQF or CROQF).
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	On completion of the course the student is expected to: (1) be acquainted with the basic physical, chemical and biological processes within surface water ecosystems, (2) understand the processes of transport and assimilation of various types of pollution in surface waters, and (3) be able to solve engineering problems related to surface water protection by application of mathematical models.
Course content broken down in detail by weekly class schedule (syllabus)	**Introduction:** general information on water quality problematic; fundamental quantities; mathematical model types, approaches and implementation; historical development of water-quality models. **Reaction kinetics**: reaction types and order; reaction rate estimation; stoichiometry; temperature effects. **Completely mixed systems:** mass balance equations – particular theoretical solutions and numerical methods; residence time; response time; feed-forward and feed-back systems of reactors and reactions; open and batch reactors. **Incompletely mixed systems:** transport mechanisms – advection, diffusion and dispersion; Fick's laws; plug flow and mixed flow reactors; point and distributed sources; instantaneous and continuous spill models; advection-dispersion equation – particular theoretical solutions, control-volume and centered-difference approaches, numerical dispersion and stability; tracer studies. **Rivers and streams:** river types; stream hydrogeometry; low-flow analysis; longitudinal and lateral dispersion; routing water and pollutants basic equations. **Lakes and reservoirs:** standing water types; morphometry; water balance; near shore models – particular theoretical solutions. **Estuaries:** salinity transport and vertical stratification; net flow; dispersion coefficient estimation. **Water quality modeling process:** problem specification, model selection, preliminary application, calibration, confirmation and management application; sensitivity analyses; assessing model performance; segmentation and model resolution. **Sediment transport modeling:** transport mechanisms; suspended solids properties; Stokes' law; bottom sediments – porosity, density and

	solids concentration; simple solids budget; bottom sediment as a vertical distributed system; resuspension process. **Pathogen modeling:** indicator organisms; bacterial loss rate; sediment-water interactions. **Dissolved oxygen modeling:** organic production/decomposition cycle; dissolved oxygen sag; BOD model for a stream – loadings, removal rates and dissolved oxygen saturation; oxygen reaeration; Streeter-Phelps equations for point and distributed sources; nitrification; photosynthesis/respiration; sediment oxygen demand**. Introduction to eutrophication modeling:** the eutrophication problem; nutrients; nitrogen and phosphorus problem; heat-transfer, mass-transfer and reaction mechanisms. **Introduction to toxic-substance modeling:** toxic problem; solid-liquid partitioning, mass-transfer and reaction mechanisms.
Format of instruction	☒ **lectures** ☐ seminars and workshops ☒ **exercises** ☐ *on line* in entirety ☐ partial e-learning ☐ field work ☒ **independent assignments** ☐ multimedia ☐ laboratory ☐ work with mentor
Student responsibilities	Regular attendance of classes. Preparation of written assignments.

Screening student work*(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*

Class attendance	2.0	Research		Practical training	
Experimental work		Report			
Essay		Seminar essay	1.0		
Tests		Oral exam			
Written exam	1.0	Project			

Grading and evaluating student work in class and at the final exam	Written examination, oral examination, oral presentation.

Required literature (available in the library and via other media)

Title	Number of copies in the library	Availability via other media
S.C. Chapra: Surface water-quality modeling, McGraw-Hill, 1997.		

Optional literature (at the time of submission of study programme proposal)	Zhen-Gang Ji: Hydrodynamics and Water Quality: Modeling Rivers, Lakes, and Estuaries, John Wiley & Sons, 2008. J.L. Martin, S.C. McCutcheon: Hydrodynamics and Transport for Water Quality Modeling, CRC Press, 1999. M.L. Spaulding: Estuarine and Coastal Modeling, American Society of Civil Engineers (ASCE), 2008.
Quality assurance methods that ensure the acquisition of exit competences	Quality assurance will be performed at three levels: (1) University level, through questionnaires; (2) Faculty level by Quality Control Committee; (3) Lecturer's level.
Other (as the proposer wishes to	

add)	