



WP2

Development of curricula

Lead Organisations of WP2: **UNS - Serbia**

Participating Organisation: UB; UNI; UBL; UNSA; INSZASUM;
BOKU; UNSCM; UNIRC; FRI-BAS

Deliverable 2.3

**Title: Established new and improved existing subjects
of bachelor and master programme**

Participating Organisation: UB; UNS; UNI; UBL; UNSA



PROJECT INFO

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CONTENT

Updated courses at the Bachelor study program Water Management at the University of Novi Sad, Faculty of Agriculture:

1. Engineering Hydrology
2. River engineering
3. Bioregulation
4. Soil Conservation Structures

Updated courses at the Master study program Water Management at the University of Novi Sad, Faculty of Agriculture:

1. Soil and Water Conservation

New courses at the Master study program Water Management at the University of Novi Sad, Faculty of Agriculture:

1. Decision making in soil erosion and torrent control
2. Application of GIS in protection against torrential floods



Updated courses at the Bachelor study program Water Management at the University of Novi Sad, Faculty of Agriculture

Study program: Water Management			
Title: Engineering Hydrology			
Lecturer: Doc. dr Boško Blagojević			
Status of the course: Compulsory			
Number of ECT: 6			
Requirement(s): Basics of Hydrology			
Objective Studying theoretical aspects of hydrology and methods for solving practical hydrology problems.			
Outcome Student's ability to process and analyze hydrological data and ability to independently apply their acquired knowledge in the field of hydrology			
Content The runoff cycle. Components of runoff. Hydrogram of runoff. Factors affecting runoff. Impact of forest ecosystems on runoff and occurrence of torrential floods. Impact of climate change on the occurrence of torrential floods. Separation of base from direct runoff. The runoff coefficient. Unit Hydrogram. Flood wave propagation in a watercourse and flood wave propagation methods. The Maskingam Method. The tangent method. Accumulations. Determination of reservoir size. Physical characteristics of the reservoir. Sum line of inflow. Accumulation management. Application of mathematical statistics in hydrology			
Literature 1. Zelenhasić, E., Ruski, M.: Inženjerska hidrologija, Naučna knjiga, Beograd, 1991 2. Zelenhasić, E.: Stohastička hidrologija, Pan-merkur, Novi Sad, 1997. 3. Prohaska, S., Ristić, V.: Hidrologija kroz teoriju i praksu, Univerzitet u Beogradu, Rudarsko-geološki fakultet, Beograd, 1996. 4. Prohaska, S.: Hidrologija I deo, Univerzitet u Beogradu, Rudarsko-geološki fakultet, Beograd, 2003. 5. Prohaska, S.: Hidrologija II deo, Univerzitet u Beogradu, Rudarsko-geološki fakultet, Beograd, 2006. 6. Rajić, M., Josimov Dunderski, J.: Inženjerska hidrologija, Univerzitet u Novom Sadu, Poljoprivredni fakultet, Novi Sad, 2011.			
Number of teaching hours (per week)	Lectures: 3	Practical classes: 4	
Teaching methods Lectures, practical classes, consultations.			
Score (maximum points 100)			
Pre-exam obligations	Points	Exam	Points
activities during the lectures	5	written exam (practical part of the exam)	
activities during the practical classes	5	oral exam (theoretical part of the exam)	60
colloquium	2x15	
Seminars			



Study program: Water Management			
Title: River engineering			
Lecturer: Prof. dr Radovan Savic			
Status of the course: Compulsory			
Number of ECT: 5			
Requirement(s): -			
Objective Introducing students to the most important characteristics of natural watercourses, the processes in them and the possible adverse events; Presentation of the necessary analyzes, calculations and basic principles of regulation measures, works and buildings for the regulation of watercourses and flood protection.			
Outcome Students' ability to identify and understand the basic principles of watercourse regulation and flood protection			
Content Basic characteristics of natural watercourses. Basic terms and definitions in the field of watercourse regulation. Motives and goals of watercourse regulation. Surveys, backgrounds and data for the purpose of watercourse regulation. Basic analyzes and calculations for the purpose of watercourse regulation. Morphological characteristics of river beds. Calculation of water flow in natural flows. Deposits. Calculation of sediment transport and bed deformation. Regulatory structures, works and measures for the regulation of the watercourse. Management of torrential catchemnts. Different concepts of watercourse landscaping. Flood protection. Causes of floods. Torrential floods. Flood damage. Active and passive flood protection measures. Flood protection; Flood Defense Plans. Navigation in watercourses. Inland waterways. Characteristics of water traffic. Facilities on navigable canals			
Literature 1. Jovanović B.M.: Regulacija reka, rečna hidraulika i morfologija, Građevinski fakultet, Beograd, 2008. 2. Babić-Mladenović M.: Uređenje vodotoka. Institut za vodoprivredu Jaroslav Černi, Beograd, 2018. 3. Kolaković S.: Odbrana od poplava, FTN. Novi Sad. 2012. 4. Tehničar - Građevinski priručnik - Odabrana poglavlja iz hidrotehnike. Građevinska knjiga, Beograd, 2007. 5. Letić Lj.: Bioregulacije, Šumarski fakultet, Beograd, 2001.			
Number of teaching hours (per week)		Lectures: 4	Practical classes: 4
Teaching methods Lectures, practical classes, consultations.			
Score (maximum points 100)			
Pre-exam obligations	Points	Exam	Points
activities during the lectures	10	written exam (practical part of the exam)	
activities during the practical classes		oral exam (theoretical part of the exam)	50
colloquium		
Seminars	40		



Study program: Water Management			
Title: Bioregulation			
Lecturer: Doc. dr Milica D. Vranešević			
Status of the course: Elective			
Number of ECT: 6			
Requirement(s): -			
Objective Introducing students to the basic phenomena and processes that disturb the natural balance of aquatic ecosystems, biotechnical properties of plants and the application of bioregulations in erosion-threatened areas			
Outcome Enabling students to work on the design, construction and maintenance of erosion protection areas in vulnerable areas through the application of bioregulations			
Content Erosion occurrence and processes. Occurrence and causes of torrential floods Erosion and torrential factors. Methods for studying, measuring and estimating soil losses and erosion intensity. Application of bioregulations (preventive and direct measures of land protection). Strategies in the application of bioregulations (agronomic measures, anti-erosion crop rotation, crop protection, mulching, grass cover). Land management measures. Torrential management measures. Regulation of running and stagnant waters by applying bioregulations. Transverse structures, longitudinal structures, regulation of watercourses, landscaping of shores. Establishment and care of coastal vegetation. Bioengineering materials. Soil degradation and ecosystem services. Cadastre of commonly used plants in bioregulations.			
Literature 1. Letić Lj. (2002): Bioregulacije, Šumarski fakultet, Univerziteta u Beogradu, Beograd 2. Kadović R. (1999): Potiverozioni agroekosistemi, Šumarski fakultet, Univerziteta u Beogradu, Beograd 3. Spalević B. (1997): Konzervacija zemljišta i voda, Poljoprivredni fakultet, Univerziteta u Beogradu, Beograd 4. Matić V. (1994): Materijali u protiverozionim radovima, Šumarski fakultet, Univerziteta u Beogradu, Beograd			
Number of teaching hours (per week)		Lectures: 2	Practical classes: 2
Teaching methods Lectures, practical classes, consultations.			
Score (maximum points 100)			
Pre-exam obligations	Points	Exam	Points
activities during the lectures	20	written exam (practical part of the exam)	
activities during the practical classes	20	oral exam (theoretical part of the exam)	60
colloquium		
Seminars			



Study program: Water Management			
Title: Soil Conservation Structures			
Lecturer: Doc. dr Milica D. Vranešević			
Status of the course: Compulsory			
Number of ECT: 5			
Requirement(s): Hydraulics, Engineering Hydrology			
Objective Introducing students to the basic principles of erosion processes and ways to combat them			
Outcome Training students to work on the design, construction and maintenance of erosion protection facilities			
Content The concept and types of soil erosion, genesis of erosion processes in the area. Wind erosion, occurrence and protection measures. Water erosion, classification, erosion factors. Systems of landscaping of erosion area, design of works. Classification of erosion management facilities. Torrential watercourses. Hydraulics of torrential streams. Objects for regulation of torrential flows, classification, purpose, materials. Transverse structures for the regulation of torrential flows, purpose, classification, elements of structures. Basic principles of static and hydraulic calculation. Water storage facilities, roles, conditions for design, construction, use and maintenance. Basics of determining the volume of reservoirs, the choice of a place for raising the dam. Dam classification. Dam elements, basic drainage, overflows, slope protection, dam drainage. Hydraulic and static calculation of dam elements. Flood wave transformation in reservoir. Organizational and economic aspects of torrential flood protection. Decision making in the management of a torrential catchments.			
Literature 1.S. Belić (1996) Vodoprivredni objekti (skripta), Novi Sad			
Number of teaching hours (per week)		Lectures: 3	Practical classes: 3
Teaching methods Lectures, practical classes, consultations.			
Score (maximum points 100)			
Pre-exam obligations	Points	Exam	Points
activities during the lectures	20	written exam (practical part of the exam)	
activities during the practical classes	20	oral exam (theoretical part of the exam)	60
colloquium		
Seminars			



Updated courses at the Master study program Water Management at the University of Novi Sad, Faculty of Agriculture

Study program: Water Management, Master			
Title: Soil and Water Conservation			
Lecturer: Prof. dr Radovan Savic			
Status of the course: Elective			
Number of ECT: 6			
Requirement(s): -			
Objective Expanding students' knowledge of erosion processes and negative impacts on soil and water bodies. Familiarity with the principles and measures of soil and water conservation			
Outcome Students' ability to identify and perceive the negative effects of erosion processes and associated phenomena; to assess the extent and consequences of the problem, select and take adequate measures of land and water protection			
Content Land and water degradation processes. Soil erosion. Erosion under agroecosystem conditions. Mechanisms of formation, operation and development of erosion processes. Torrential floods. Erosion and Torrents. Models for the prediction and estimation of erosion intensity. Effects of erosion on the environment. Sediments (origin, properties, transport, deposition, impact on the waters). Importance, role and goals of land and water conservation. Basic principles of soil and water conservation. Agricultural measures of soil and water conservation. Biotechnical measures of soil and water conservation. Modern strategies and complex methods of land and water conservation. Integral management of torrential catchments. Relevant legislation.			
Literature 1. Đorović M.: Vodna i eolska erozija zemljišta, JDPZ, Beograd, 2005. 2. Kostadinov S.: Bujični tokovi i erozija. Šumarski fakultet, Beograd, 2008 3. Kadović R.: Protiverozioni agroekosistemi, Konzervacija zemljišta, Šumarski fakultet, Beograd, 1999. 4. Letić Lj.: Bioregulacije, Šumarski fakultet, Beograd, 2001. 5. Mendez R.V. Soil Erosion: Processes, Prediction, Measurement and Control. Koros Press Limited. 2017.			
Number of teaching hours (per week)	Lectures: 2		Practical classes: 2
Teaching methods Lectures, practical classes, consultations.			
Score (maximum points 100)			
Pre-exam obligations	Points	Exam	Points
activities during the lectures	10	written exam (practical part of the exam)	
activities during the practical classes		oral exam (theoretical part of the exam)	50
colloquium		
Seminars	40		

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New courses at the Master study program Water Management at the University of Novi Sad,
Faculty of Agriculture

Curriculum: Water Management			
Course title: Decision making in soil erosion and torrent control			
Instructor(s): Boško Blagojević			
Status of the course: Elective		Course code:	
Number of ESPP: 6			
Requirement(s): -			
Course goal The course aims to contribute to the students' understanding of Multi-Criteria Decision Analysis (MCDA) and how to apply it step-by-step by using decision-making problems from soil erosion and torrent control management. The participants will learn how to structure complex decision problems and break them down into manageable parts. An important aim is to learn how to elicit subjective preferences from decision makers and how to use computer-based tools for MCDA.			
Course outputs Upon completion of this course, the student will be able to: <ul style="list-style-type: none"> structure multi-criteria decision making problems (goal or objective of decision making, criteria, sub-criteria, and alternatives), understand basic cognitive and motivational biases and learn how to minimize them during multi-criteria decision making, explain basics of commonly used MCDA methods and learn how to apply them, discuss philosophies and pros and cons of different methods, reflect upon which method(s) can be appropriate for different type of decision making problems. 			
Course content Introduction to MCDA; Problem structuring methods; Linear programming; Goal, aspiration or reference level methods (Goal programming, Compromise programming, TOPSIS); Outranking methods (PROMETHEE method); Value measurement methods (Analytic Hierarchy Process (AHP) and Multi Attribute Value Theory (MAVT)); Group Decision Making; Cognitive and motivational biases in decision making; Application of MCDA in soil erosion and torrent control.			
Readings <ol style="list-style-type: none"> Ishizaka, A., Nemery, P., 2013: Multi-criteria decision analysis: methods and software. John Wiley & Sons Kangas, A., Kurttila, M., Hujala, T., Eyvindson, K., Kangas, J., 2015: Decision support for forest management, second edition, Springer Berlin, 307 p. URL: https://link.springer.com/book/10.1007%2F978-3-319-23522-6 Montibeller, G., Winterfeldt, D. (2015): Cognitive and motivational biases in decision and risk analysis. Risk Analysis 35(7): 1230–1251. https://doi.org/10.1111/risa.12360 Kostadinov S. (2008): Bujični tokovi i erozija. Šumarski fakultet, Beograd. 			
Number of teaching hours (per week)			
Lectures	2	Practical classes	2
		Other forms of teaching	SIR/IR
			- Other classes
			-
Teaching methods The course consists of a combination of lectures, case-based learning, teacher-led class-room exercises, self-study literature, work on individual assignment and students' presentations.			
Score (maximum points 100)			
Pre-exam obligations	Points	Exam	Points
activities during the lectures	10	written exam (practical part of the exam)	40
activities during the practical classes	10	oral exam (theoretical part of the exam)	40
colloquium			

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Study program: Water Management, Master			
Title: Application of GIS in protection against torrential floods			
Lecturer: Doc. dr Atila Bezdán			
Status of the course: Elective			
Number of ECT: 6			
Requirement(s): -			
Objective Mastering the basics of Geographic Information Systems (GIS) and their application in the spatial analysis of degraded areas in order to restore and protect land and water resources			
Outcome Application of GIS tools for analysis of natural and anthropogenically altered characteristics of land, as a basis for design, planning and research purposes			
Content GIS product, geocoded information, application capability, linking geographic and attribute features, data visualization. Using georeferenced grids. Models for terrain elevation representation (TIN, DEM, DTM), Modeling of land use in GIS, runoff coefficient, roughness coefficient. Modeling of hydrographic network, modeling of meteorological data, modeling of soil types, watersheds and catchments in GIS. Management of processes and resources in GIS. Application of GIS and hydraulic software in water resource management functions.			
Literature 1. Longley P., Goodchild M., Maguire D., Rhind D. :Geographic Information Systems and Science, John Wiley and Sons, LTD. 2002 2. Jovanović V., Đurđev B., Srdić Z., Stankov U.: Geografski informacioni sistemi, Univerzitet Singidunum i Univerzitet u Novom Sadu, Beograd, 2012 3. Benka P., Bezdán A.: Geografski informacioni sistemi – Praktikum, Poljoprivredni fakultet, Novi Sad, 2016			
Number of teaching hours (per week)		Lectures: 2	Practical classes: 2
Teaching methods Lectures, practical classes, consultations.			
Score (maximum points 100)			
Pre-exam obligations	Points	Exam	Points
activities during the lectures	10	written exam (practical part of the exam)	
activities during the practical classes		oral exam (theoretical part of the exam)	50
colloquium		
Seminars	40		