

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	Hidrologija in okolje
<b>Course title:</b>	Hydrology and Environment

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Ekotehnologije, 3. stopnja		1	1
Ecotechnologies, 3 <sup>rd</sup> cycle		1	1

**Vrsta predmeta / Course type** Izbirni / Elective

**Univerzitetna koda predmeta / University course code:** EKO3-747

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
15	15			15	105	5

*\*Navedena porazdelitev ur velja, če je vpisanih vsaj 10 študentov. Drugače se obseg izvedbe kontaktnih ur sorazmerno zmanjša in prenese v samostojno delo. / This distribution of hours is valid if at least 10 students are enrolled. Otherwise the contact hours are linearly reduced and transferred to individual work.*

**Nosilec predmeta / Lecturer:** Prof. dr. Sonja Lojen

<b>Jeziki / Languages:</b>	<b>Predavanja / Lectures:</b>	Slovenščina, angleščina Slovene/English
	<b>Vaje / Tutorial:</b>	Slovenščina, angleščina Slovene/English

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

Zaključena druga stopnja bolonjskega študija programa s področja naravoslovja, tehnologije ali tehnike; osnovno znanje geologije.

**Prerequisites:**

Completed Bologna second level degree in natural sciences, technology or engineering; basic knowledge of geology.

**Vsebina:**

Hidrosfera in vodni cikel

Padavine: nastanek in vrste padavin, geografska in časovna porazdelitev, interakcije z atmosfero in geosfero, meritev padavin, izredni padavinski dogodki in njihova ponovljivost, padavinska erozija

Infiltracija in talna voda: razmerje tla-voda, osnovne karakteristike tal, zadrževanje talne vode, vodna bilanca tal, analiza talne vlage in hitrosti infiltracije, gibanje vode skozi talne horizonte in interakcije v vodi raztopljenih snovi s tlemi

Evapotranspiracija: osnovni procesi evapotranspiracije, evapotranspiracija tal in rastlin, zadrževanje vode v tleh in rastlinskem pokrovu,

**Content (Syllabus outline):**

Hydrosphere and hydrological cycle

Precipitation: formation and classification of precipitation, geographical and temporal distribution, interactions with atmosphere and geosphere, precipitation measurement, extreme precipitation events, erosion

Infiltration and Soil Water Processes: soil-water relationship, basic soil characteristics, soil-water retention, soil water balance, soil water analysis, infiltration rate, water movement through soil horizons, interactions of water and water-borne substances with soils

Evaporation: basic evapotranspiration processes,

merjenje evaporacije in evapotranspiracije, vhodni podatki in izračuni

Površinski odtok in podzemni tok: karakteristike povodja, ki vplivajo na odtok, značilnosti površinskega odtoka, ocena in napovedovanje površinskega odtoka, hidrografske metode, izredni dogodki, podpovršinski tok, modifikacije površinskega odtoka pri upravljanju voda

Reke: interakcija rek s krajino, značilnosti rek in rečne biote, evolucija reke, stabilnost toka, transport snovi po reki, upravljanje zlivnih območij

Varovanje tal in sedimentna bilanca: erozija, izguba tal, koncept sedimentne bilance

Hidrogeologija: podzemni tok, interakcija vode in v njej raztopljenih snovi s prikamnino, vodonosniki

Človek in vodni krog: metode ocene stanja vode, urbana hidrologija, poplave, zadrževanje vode, sistemi za obdelavo vode, hidrologije deponij

soil and plant evapotranspiration, water retention in soil and vegetation, water uptake, evaporation and evapotranspiration measurements, input parameters, calculation

Surface Runoff, Interflow, and Subsurface Drainage: watershed characteristics, runoff characteristics, estimation and forecast of runoff, extreme events, subsurface water flow, modifications of surface flow in water management

Stream Processes: interaction between river and landscape, river evolution, material transport, catchment management

Soil and water: soil erosion, soil loss, sediment balance concept

Hydrogeology: groundwater flow, water-rock interaction, aquifers

Human Impacts on the Hydrologic Cycle: water status assessment, urban hydrology, forecast and regulation of flood events, water retention, water treatment systems, landfills

Remote Sensing and Geographic Information System Applications

#### Temeljni literatura in viri / Readings:

Ward, A.D., Trimble, S.W., Burckhard, S.R. 2015. Environmental Hydrology. 3rd edition, CRC Press, ISBN-13: 978-1466589414.

Appelo, C.A.J., Postma, D., 2005. Geochemistry, Groundwater and Pollution. Taylor & Francis, ISBN-13: 978-0415364287.

#### Cilji in kompetence:

Osnovni cilj predmeta je razumevanje osnov vodnega cikla, transporta snovi v hidrosferi in njene interakcije z litosfero, biosfero, atmosfero in človekom. Študentje morajo razumeti zakonitosti kroženja vode na in pod zemeljskim površjem ter razpoložljivosti vode. Študentje morajo obvladati procese v hidrološkem ciklu, glavne hidrokemijske in hidrogeološke procese, spoznati tehnike določanja pomembnih hidroloških parametrov in odnosa med vodo, sferami v naravi (litosfera, biosfera, atmosfera), človekovo dejavnostjo in zdravjem človeka in okolja.

#### Objectives and competences:

The main goal of the course is understanding of hydrological cycle, material transport through hydrosphere and interactions with lithosphere, biosphere and atmosphere. The course focuses on interactions between man and natural environment, as well as the consequences of human activities for environment degradation and protection. Students learn to understand the water cycling and related hydrochemical and hydrogeological processes at the surface and underground and the availability of water, and their relation to human activities. They also learn the basic techniques for determination of hydrological parameters.

**Predvideni študijski rezultati:**

Študenti po koncu programa:

- obvladajo osnovne pojme iz hidrogeologije in razumejo zakonitosti kroženja vode v naravi,
- identificirajo in razumejo hidrogeološke procese v podzemnih in površinskih vodnih telesih ,
- razumejo vlogo vode pri kroženju snovi v naravi in v opazovanem okolju,
- identificirajo hidrološke probleme v povezavi s kakovostjo posameznih segmentov in okolja kot celote v prostoru in času,
- povezujejo interdisciplinarna znanja za trajnostno in učinkovito upravljanje voda,
- sposobni so proaktivno sodelovati v interdisciplinarni raziskovalni skupini na področju raziskovanja in upravljanja okolja,
- učinkovito komunicirajo tematiko in nova spoznanja strokovni in laični javnosti.

**Intended learning outcomes:**

At the end of the course, students will:

- understand basic terms and phenomena in hydrogeology and water cycle
- Identify and understand hydrogeological processes in groundwater and surface water
- Understand the role of water in cycling of substances in nature and in the observed environment
- Identify hydrological problems in relation to environmental quality in different environmental compartments and environment as a whole in space and time
- Use interdisciplinary knowledge for sustainable and efficient water management
- Have ability for proactive participation in interdisciplinary environmental research
- Efficiently communicate hydrogeological and environmental topics and knowledge to expert and non-expert publics

**Metode poučevanja in učenja:**

Seminar, predavanja, konzultacije

**Learning and teaching methods:**

Seminar, lecture, consultation

<b>Načini ocenjevanja:</b>	<b>Delež (v %) / Weight (in %)</b>	<b>Assessment:</b>
Seminarska naloga	50 %	Seminar
Ustni izpit	50 %	Oral examination

**Reference nosilca / Lecturer's references:**

Domínguez-Villar, D., Lojen, S., Krklec, K., Kozdon, R., Edwards, L. R., Cheng, H. 2018i. Ion microprobe  $\delta^{18}\text{O}$  analyses to calibrate slow growth rate speleothem records with regional  $\delta^{18}\text{O}$  records of precipitation. *Earth and planetary science letters* 482, 367-376.

Zavadlav, S., Rožič, B., Dolenc, M., Lojen, S., 2017. Stable isotopic and elemental characteristics of recent tufa from a karstic Krka River (south-east Slovenia): useful environmental proxies? *Sedimentology* 64, 808-831.

Domínguez-Villar, D., Vázquez-Navarro, J. A., Krklec, K., Lojen, S., Fairchild, I. J. 2017. Laminated tufa sediments formed from overflow karst springs: controls on their deposition and carbon-oxygen isotope records. *Sedimentology* 64, 1274-1288.

Zavadlav, S., Kanduč, T., McIntosh, J., Lojen, S., 2013. Isotopic and chemical constraints on the biogeochemistry of dissolved inorganic carbon and chemical weathering in the karst watershed of Krka river (Slovenia). *Aquatic geochemistry* 19, 209-230.

Cukrov, N., Cuculić, V., Barišić, D., Lojen, S., Mikelić, L., Oreščanin, V., Vdović, N., Fiket, Ž., Čermelj, B., Mlakar, M. 2013. Elemental and isotopic records in recent fluvio-lacustrine sediments in karstic river Krka, Croatia. *Journal of geochemical exploration* 134, 51-60.