

## UČNI NAČRT PREDMETA/COURSE SYLLABUS

<b>Predmet:</b>	Geodezija
<b>Course title:</b>	Geodesy

<b>Študijski programi in stopnja</b>	<b>Študijska smer</b>	<b>Letnik</b>	<b>Semestri</b>
Geologija, prva stopnja, univerzitetni	Ni členitve (študijski program)	2. letnik	

**Univerzitetna koda predmeta/University course code:** 963

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
30	0	15	0	0	45	3

**Nosilec predmeta/Lecturer:** Milivoj Vulić

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

<b>Jeziki/Languages:</b>	<b>Predavanja/Lectures:</b>	Angleščina, Slovenščina
	<b>Vaje/Tutorial:</b>	Angleščina, Slovenščina

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

Pogoj za vključitev v delo je vpisan izbirni predmet v dodiplomskem študiju.

**Prerequisites:**

The condition for inclusion is enrolled elective subject in undergraduate study.

**Vsebina:**

Oblika in velikost Zemlje, zemeljsko površje.  
Aproksimacije oblike Zemlje: kroglja, rotacijski elipsoid, geoid.  
Koordinatni sistemi in koordinatni sestavi v geodeziji, vrste koordinat za opis lege točke v prostoru.  
Osnovni pojmi o kartografskih projekcijah, Prečna Mercatorjeva (TM) projekcija.  
Tipi višin v geodeziji.  
Prikazovanje zemeljskega površja na načrtih in kartah.  
Osnovni pojmi o merjenju, osnovni pojmi o kakovosti meritev.  
Metode geodetske izmere.  
Horizontalna terestrična geodetska izmera: triangulacija, trilateracija, poligonometrija.  
Višinska terestrična geodetska izmera: nivelman, gravimetrija.  
Osnove fotogrametrije, daljinskega zaznavanja in laserskega skeniranja.  
Uporaba GNSS (Globalnih Navigacijskih Satelitskih Sistemov) v geodetski izmeri.

**Content (Syllabus outline):**

The size and shape of the Earth, the Earth's surface.  
Approximations of the Earth's shape: sphere, rotational ellipsoid, geoid.  
Coordinate systems and coordinate compositions in geodesy, types of coordinates used to describe the position of a point in space.  
Types of heights in geodesy.  
Presentation of the Earth's surface on plans and maps.  
Basic concepts concerning measurement, basic concepts concerning the quality of measurements.  
Methods of geodetic measurement.  
Horizontal terrestrial geodetic measurement: triangulation, trilateration, polygonometry.  
Basics concerning photogrammetry, remote sensing and laser scanning.  
Use of GNSS (Global Navigation Satellite Systems) in geodetic measurements.

**Temeljna literatura in viri/Readings:**

VULIĆ, Milivoj, Metoda najmanjših kvadratov, 1.izd., Ljubljana: Naravoslovnotehniška fakulteta, Oddelek za geotehnologijo in rudarstvo, 2007, ISBN: 978-961-6047-49-4 234924288.  
Charles D. GHILANI, Paul R. WOLF, Elementary Surveying: An Introduction to Geomatics, 13th Edition.

**Cilji in kompetence:**

CILJI: Slušatelji spoznajo osnovne geometrijske lastnosti Zemlje kot planeta, njeno obliko in velikost ter aproksimacije oblike Zemlje. Spoznajo koordinatne sisteme in tipe koordinat za podajanje lege točke v prostoru ter principe preslikav površja Zemlje v ravnine kartografskih projekcij. Spoznajo sile, ki ustvarjajo težnostno polje Zemlje: silo teže, gravitacijsko in centrifugalno silo ter se seznanijo s povezavo med geometrijo prostora in silo teže. Spoznajo osnovne merske tehnike za potrebe pridobivanja prostorskih podatkov ter prikazov vsebin zemeljskega površja. Spoznajo tudi osnovne pojme o merjenju ter oceni kakovosti opravljenih meritev.

KOMPETENCE: Pridobijo osnovna znanja o geometrijskih in fizikalnih lastnostih Zemlje kot planeta. Usposobijo se za pridobivanje osnovnih podatkov o geometriji prostora s preprostimi metodami geodetske izmere, njihovo obdelavo in interpretacijo.

**Objectives and competences:**

OBJECTIVES: Students learn about the basic geometric properties of the Earth as a planet, its shape and size, and approximations of the Earth's shape. They learn about coordinate systems and types of coordinates needed to describe the position of a point in space, and about the principles to do with mapping the Earth's surface onto cartographic projection planes. They learn about the forces that generate the Earth's gravitational field: the force of gravity, the gravitational and centrifugal force, and they familiarise themselves with the connection between the geometry of a space and the force of gravity. They acquaint themselves with basic measurement techniques for the purpose of acquiring spatial data and displaying content of the Earth's surface. They acquaint themselves with basic concepts to do with measurement and measurement quality evaluation. COMPETENCES: They acquire basic knowledge concerning the geometrical and physical properties of the Earth as a planet. They are trained to acquire basic information about the geometry of a space through simple methods of geodetic surveying, processing and interpretation.

**Predvideni študijski rezultati:**

Študent spozna osnove geodezije in njeno terminologijo. Pozna geometrijske lastnosti Zemlje, njeno velikost in obliko. Razume osnovne pojme o koordinatnih sistemih in vzpostavitvah koordinatnih sestavov v geodeziji. Pozna osnovne tipe koordinat za opis lege točke v prostoru. Razume proces merjenja, napak in pogreškov pri merjenju ter zna oceniti osnovne parametre kakovosti opravljenih meritev, kot so natančnost, točnost, zanesljivost. Pozna osnovni namen in naloge terestrične geodetske izmere za določitev horizontalnega položaja in višine. Razume osnovne principe fotogrametričnega zajema ter daljinskega zaznavanja prostorskih podatkov. Spozna osnove terestričnega in letalskega laserskega skeniranja ter zna interpretirati pridobljene podatke. Razume možnosti uporabe GNSS v geodetski izmeri in povezavo GNSS metod geodetske izmere s klasičnimi terestričnimi postopki izmere. Poznavanje osnov geodezije je ključno za geološko terensko delo, kjer je pomemben tudi podatek o legi v prostoru. Poznavanje načinov opisa lege, njenega prikazovanja ter osnovnih parametrov njene kakovosti je pomembno na vseh področjih stroke, tako v raziskovalnem delu kot v operativni praksi. Poznavanje geodetskih merskih tehnik je pomembno pri praktičnih delih povezanih z določitvijo in spremljanjem lege za potrebe spremljanja stabilnosti naravnega okolja od posedanj zemeljskega površja, zemeljskih plazov do pridobivanja podatkov o aktivnih tektonskih procesih na ozemlju. Spoznavanje miselnega procesa postavljanja hipotez in modelov v geologiji, od deskriptivnega opisovanja (geometrija objekta) preko kinematskega modela (razlaga premikanj in deformacij, ki so privedle do današnjega stanja geološkega objekta) do

**Intended learning outcomes:**

Students learn about the basics of geodesy and its terminology. They are acquainted with the geometric properties of the Earth, its shape and size. They understand basic concepts to do with coordinate systems and the establishment of coordinate compositions in geodesy. They know the basic types of coordinates needed to describe the position of a point in space. They understand the measurement process, measurement errors and are able to estimate the basic quality parameters of measurements, such as precision, accuracy, reliability. They know the basic purpose and functions of terrestrial geodetic measurements in determining horizontal position and height. They understand basic principles to do with photogrammetric capturing and remote sensing of spatial data. They are familiar with the basics of terrestrial and air laser scanning, and know how to interpret the acquired data. They understand the possibility of using GNSS in geodetic surveying and the connection between GNSS methods and conventional terrestrial surveying methods. Knowing the basics of geodesy is key to geological field work, wherein data concerning positions in space is also important information. Knowing the ways to describe position, present it, and its basic quality parameters is important in all areas of the profession, in research as well as in operational practice. Knowledge of geodetic measurement techniques is important in practical work associated with the defining and monitoring of position for the purposes of monitoring the stability of the natural environment due to subsidence of the Earth's surface, landslides, and for the purposes of obtaining data on active tectonic processes in the area. Getting to know the

<p>mehanskega modela (kvantitativni opis mehanike procesov deformiranja). Na podlagi recentnih primerov morajo študenti razumeti tektonska dogajanja in okolja v geološki preteklosti. Naučijo se zbirati, vizualizirati in analizirati geološke podatke in generalizirati podatke v interpretativni model. Študent se nauči opazovanja in evidentiranja geoloških pojavov na terenu. Terenska opažanja se navadi interpretirati, generalizirati in sintetizirati. Nauči se podajanja rezultatov terenskega dela in lastnih interpretacij v obliki zaključenega terenskega elaborata (poročila). Študent se nauči iskanja po literaturnih virih in njihove kritične uporabe. Uči se timskega dela.</p>	<p>thought process of setting hypotheses and models in geology, from the descriptive description / descriptive characterisation (object geometry) through the kinematic model (an explanation of movements and deformations that have led to the present state of a geological object) to the mechanic model (a quantitative description of the mechanics of deformation processes). Based on recent examples, students must be able to understand tectonic events and environments in the geological past. Students learn to collect, visualise and analyse geological data and generalise the data into an interpretive model. Students learn to observe and document geological phenomena in the field. Students are accustomed to interpreting, generalising and synthesising field observations. They learn to present field work results and their own interpretations of them in the form of a completed field report. Students learn to search through literary sources and apply them critically. They learn to engage in teamwork.</p>
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<p><b>Metode poučevanja in učenja:</b> Predavanja, e-učenje, kabinetne vaje (učenje grafičnega in analitičnega reševanja praktičnih primerov), vaje v računalniški učilnici (učenje uporabe programske opreme za obdelavo podatkov geodetske izmere), terenske vaje (pri terenskih vajah študenti opravijo več praktičnih primerov geodetske izmere, podatke izmere in nato podatke samostojno obdelajo, analizirajo in prikažejo v grafični in digitalni obliki).</p>	<p><b>Learning and teaching methods:</b> Lectures, e-learning, cabinet practicals (learning to solve practical problems graphically and analytically), computer lab practicals (learning to use software intended for geodetic measurement data processing), field work (during field work, students undertake many practical examples of geodetic measurements, then deal in data measurement and independently process, analyse and display the data in graphical and digital form).</p>
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<b>Načini ocenjevanja:</b>	<b>Delež/Weight</b>	<b>Assessment:</b>
pisni izpit	60,00 %	written exam
ustno izpraševanje	40,00 %	oral exam
<p>Način: pisni izpit (60%) in ustno izpraševanje (40%). Pri praktičnem delu izpita študenti pisno rešujejo probleme s področja geodezije. Pri teoretičnem delu izpita študenti pisno odgovarjajo na vprašanja iz teoretičnih vsebin (snov predavanj): praktični del (25%) teoretični del izpita (50%) poročila (25%). Ocenjevalna lestvica: (6-10) pozitivno, ob upoštevanju Statuta UL in fakultetnih pravil.</p>		<p>Type: written exam and oral exam. During the practical exam, students solve problems from the field of geodesy in written form. During the theoretical exam, students answer questions concerning theoretical content (lecture material): practical examination (25%) theoretical examination (50%) reports (25%). Grades: (6-10) positive assessment, according to University Statute and Faculty Acts.</p>

<p><b>Reference nosilca/Lecturer's references:</b> BORISOV, Mirko, HRIB, Žiga, VULIĆ, Milivoj. Low-cost photogrammetry in mining. Podzemni radovi, 2012, god. 20, br. 21, str. 169-175. NINKOV, Toša, BULATOVIĆ, Vladimir, MALENKOVIĆ, Vladimir, VULIĆ, Milivoj. Contemporary methods of determining energy losses in structures. TTEM. Tech. technol. educ. manag., 2012, vol. 7, no. 2, str. 687-692. GANIĆ, Aleksandar, RISTOVIĆ, Ivica, DJORDJEVIĆ, Dragan, VULIĆ, Milivoj. Parametric adjustment of a junction triangle in terms of the precise construction of haulage drives in underground mines = Nivelamento indireito do triangulo de conexao em funcao de escolha de vias optimais de transporte em minas subterraneas. REM. Rev. Esc. Minas (Impr.), 2010, vol. 63, no. 3, str. 529-538. ROŠER, Janez, VULIĆ, Milivoj. The error curve and error surface i.e. the confidence pedal and confidence pedaloid = Krivulja pogrešaka i ploha pogrešaka to jest pedala povjerenja i pedaloid povjerenja. TTEM. Tech. technol. educ. manag., 2010, vol. 5, no. 2, str. 321-333. MEDVED, Milan, GANIĆ, Aleksandar, VULIĆ, Milivoj. An analysis of the impact of errors occurring in the auxiliary parameters while determining geometric corrections of distance. Geod. list, 2012, vol. 66(89), no. 1, str. 21-38.</p>
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