1. GENERAL INFORMATION

Study programme title	University graduate study programme in mining engineering Subprogramme Geotechnical engineering		
Course title	Statistics	**Semester**	I.
Teacher	Assist. Prof. Anja Vrbaški, PhD	**Course code**	27085
Course type	☒ obligatory ☒ elective	**ECTS**	5
Location	Faculty of Mining, Geology and Petroleum Engineering, Pierottijeva 6, 10000 Zagreb		
Language	☒ Croatian ☐ English		

Class type	Weekly hours	Teaching staff	Office hours	Room	E-mail
Class	2	Assist. Prof. Anja Vrbaški, PhD	Tuesday 1-3 p. m.	V 106	anja.vrbaski@rgn.hr
Practice	2	Assist. Prof. Anja Vrbaški, PhD	Tuesday 1-3 p. m.	V 106	anja.vrbaski@rgn.hr
Field lecture					

E-learning level	1	**Percentage of on-line class (max. 20%)**	5%

2. COURSE DESCRIPTION

Course aims	Adoption of basic concepts from the area of probability and their application in building models for statistical analysis. Getting acquainted with basic statistical methods and acquiring skills for their application in technology and natural sciences.
Requirements for applicants	Conditions: none Competences: basic calculus (function derivative, integral, limit)
Programme level learning outcomes with course contribution	Use basic knowledge in the field of technical and natural sciences. Solve medium complex problems in geological engineering and geology, as well as in other areas which use the results of research in geological engineering and geology and apply them. Select and apply the appropriate analytical methods and procedures and equipment required in laboratory and field research. Use current information technologies to collect and process data collected through new research or from existing literature, databases and other

	sources of information. Analyze the chemical and morphological composition of the rock. Understand the impact of petroleum - mining works on the environment. Supervise the work and operation of oil and gas production, equipping, production, transport and storage systems. Understand the geological processes, rock formation and mineral raw materials deposits formation, engineering geo-geological and hydrogeological relationships, soil mechanics and rocks, and of mineral and chemical composition of rock. Planning, conducting and controlling mining and geophysical investigations for the purpose of establishing reserves of solid mineral raw materials and conducting engineering works in soil and rock. Analysis and interpretation of data collected by field and laboratory research, and determination of quality of mineral raw materials. Application of analytical and numerical methods in the assessment of the state and behavior of geological materials during engineering works and construction of various geotechnical objects in soil and rocks. Planning and implementation of geotechnical and geophysical investigations and their monitoring for the purpose of carrying out engineering works in soil and rock and establishing reserves of solid mineral raw materials. Analysis and interpretation of field and laboratory research results. Understanding the complex physical-chemical relations in the air, water, soil, multiphase fluid flow through the soil / rock, geochemical and mineral relations in the soil and rock, and the ability to identify, quantify and solve the associated problems. Modeling and numerical calculations of environmental pollution spreads.
Expected course level learning outcomes (4-10 outcomes)	After passing the exam, students will be able to: - define the concept of a random event and basic operations with events; - apply basic combinatorial terms (variations, permutations, combinations), the complete probability formula and the Bayesian formula when calculating probabilities of events; - explain the concept of discrete and continuous random variable and calculate their parameters (mathematical expectation, variance, standard deviation); - define binomial, Poisson and normal distribution and apply them in calculating probabilities of events; - graphically display statistical data and calculate the basic characteristics of the data set (arithmetic mean, variance, standard deviation); - perform a point and an interval estimate of an expectation and variance of a random variable;

	- test a statistical hypothesis with a properly selected statistical test (F-test, t-test, chi-square test); - apply a linear regression model when examining the dependence of the two characteristics of the observed phenomenon; - correctly interpret the results of statistical methods; - apply programming language R in solving statistical problems

Course contents by individual lessons	
Class	Practice
	The practice classes are following the lecture classes. The statistical concepts are accompanied by examples performed in the programming language R.
P1 Combinatorics.	V1 Combinatorics.
P2 Random event and its probability.	V2 Random event and its probability.
P3 Probability. Discrete random variable.	V3 Probability. Discrete random variable.
P4 Continuous random variable. Cumulative distribution function.	V4 Continuous random variable. Cumulative distribution function.
P5 Transformation of random variable. Parameters of random variable. Distribution.	V5 Transformation of random variable. Parameters of random variable. Distribution.
P6 Binomial and Poisson distribution.	V6 Binomial and Poisson distribution.
P7 Normal distribution.	V7 Normal distribution.
P8 chi-square, t- and F- distributions. Arranging data.	V8 chi-square, t- and F- distributions. Arranging data.
P9	V9

Data set characteristics.	Data set characteristics.
P10 Random sample. Unbiased estimate of expectation and variance. Interval estimate of expectation from a large sample.	V10 Random sample. Unbiased estimate of expectation and variance. Interval estimate of expectation from a large sample.
P11 Interval estimate of expectation from a small sample. Determining the required sample size. Interval estimate of variance.	V11 Interval estimate of expectation from a small sample. Determining the required sample size. Interval estimate of variance.
P12 Statistical test. Chi-square test.	V12 Statistical test. Chi-square test.
P13 F-test. t-test.	V13 F-test. t-test.
P14 Two-dimensional random variable.	V14 Two-dimensional random variable.
P15 Linear correlation. Regression line.	V15 Linear correlation. Regression line.

Students' obligations	Regular presence at the classes			
Students' work track *(indicate share in ECTS points for each activity so that overall ECTS number corresponds to class credits score):*	Class attendance		Research	
	Project		Report	
	Colloquium	3	Seminar paper	
	Practical work		Oral exam	2
	Written exam		(Extra)	
Type of exam, grades and evaluation of students work during class and on final exam	During the semester, students have the option of taking a non-compulsory colloquium. At the end of the semester, the students who passed the colloquium should solve the assignment (statistical analysis of a smaller data set) and explain the applied methods and the obtained results in the oral part of the exam. The final grade is based on the result on the colloquium (50% of the grade), the result on solving the assignment (30% of the grade) and the oral exam (20%). Other students that have attended the classes (at least 70% of the hours) can access the exam during the exam-terms, consisting of the written and oral part, where a positive result of the written part of the exam is the condition for assessing the oral part of the exam, and the final grade is formed according to the performance on the written and the oral part of the exam (70% written, 30% oral).			

Mandatory literature (available in the Library and via other media)	S. Pfaff: Osnove statistike, Element, Zagreb, 2012.
Aditional literature (at the moment of study program proposition application)	Ž.Pauše: Uvod u matematičku statistiku, Školska knjiga, Zagreb, 1993.; Spiegel, L.J. Stephens: Schaum's Outline of Statistics, McGraw-Hill, 2008.; P. Vranjković: Zbirka zadataka iz vjerojatnosti i statistike, Školska knjiga, Zagreb, 1990.; I. Pavlić: Statistička teorija i primjena, Tehnička knjiga, Zagreb, 1985.
Examination terms	Seven times in an academic year, during the Faculty exam-terms (February, April, June, September)
Other	

Course Teacher:

Doc. dr. sc. Anja Vrbaški

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