Course Unit Descriptor

Study Programme: Geodesy	
Course Unit Title: Theory of Measurement Errors	
Course Unit Code:	
Name of Lecturer(s): Associate Professor Vukan Ogrizović	
Type and Level of Studies: Bachelor Academic Degree	
Course Status (compulsory/elective): Compulsory	
Semester (winter/summer): Winter	
Language of instruction: English	
Mode of course unit delivery (face-to-face/distance learning): Face-to-face	
Number of ECTS Allocated: 5	
Prerequisites: None	

Course Aims:

Introducing basic terms and ways of statistical methods and concepts application in processing and analysis of geodetic measurements.

Learning Outcomes:

Students are skilled in quality analysis of geodetic measurements results and unknown parameters estimation in geodetic models.

Syllabus:

Theory

1. Introduction to probability theory. Statistical experiment, probability area. Probability axioms. Equal-probability events. Geometrical probability. Statistical definition of probability.
2. Probability features. Combinatorics application. Infinite sets of elementary events. Discrete and continual random variables. Distribution function. Random vectors. Functions of random variables and random vectors.
3. Numerical characteristics of random variables. Mathematical expectation. Average value and expected value. Normal and other distributions. Dispersion and standard deviation. Two-dimensional and multiple-dimension distributions. Correlation coefficient. Variance-covariance matrix.
4. Error types. Errors distribution. Systematic errors. Methods for decreasing influence of systematic errors. Random errors - distribution, features, function of distribution.
5. Measures and criteria of measurements results accuracy - mean square, absolute, relative, average, measurements results interval. Confidence intervals.
6. Confidence ellipses and confidence ellipsoids. Stochastic dependence of measurements.
7. Test I
8. Functions of measurement results. Error propagation law. Negligence principles.
9. Estimation theory - estimation types, obtaining estimations, direct measurements.
10. Basics of hypotheses testing. Hypotheses of the expected value.
11. Testing equality of two expected values.
12. Testing dispersion hypotheses. Bartlett test.
13. Correlation testing.
14. Distribution testing. χ^2 distribution test.

15. Test II	

Practice

Practical exercises follow the lectures schedule.

Required Reading:

1. G. Perović: Račun izravnanja 1, teorija grešaka, Naučna knjiga, Beograd, 1987.

Weekly Contact Hours: 60	**Lectures:** 30	**Practical work: 30**

Teaching Methods:

Lectures and students group work

Knowledge Assessment (maximum of 100 points): 100

Pre-exam obligations	points	**Final exam**	points
Active class participation	5	written exam	
Test I and Test II	5 (practice) + 40	oral exam	50
Preliminary exam(s)		…….	
Seminar(s)			

The methods of knowledge assessment may differ; the table presents only some of the options: written exam, oral exam, project presentation, seminars, etc.