MODULE INFORMATION SHEET

Name of Module Unit	**Statistics in Environmental Sciences**
Name in polish language	Statystyka w Badaniach Środowiska
Module type	compulsory
Form of studying	full-time day courses
Level of study	undergraduate course (B.Sc. level)
Type of study (for extra-mural courses)	-
Programme	Environmental Engineering
Speciality	Environmental Engineering
Responsible department	Department of Informatics and Environment Quality Research
Responsible person	Prof. nzw. dr hab. inż. Jarosław Zawadzki

Semester	Lectures(E)	Tutorials	Laboratory	Computer Exercises	Projects	ECTS
3	15	15	-	-	-	3

Objectives (summary)

The objective of the course is to provide the students with basic statistical concepts and methods, both descriptive and inferential such as: descriptive statistics, probability, random variables, probability distributions, estimation, statistical hypotheses, analysis of variance, correlation and regression methods, as well as elements of distribution-free procedures or geostatistics. Emphasis is placed on the use of these methods in solving both ecological and environmental engineering problems. The main concepts are illustrated by numerous examples and exercises concerning environmental problems. After the course, the students will be able to analyze and solve basic problems of statistical nature in various fields of their further study.

Prerequisites

Calculus I, II, Information Technology
Physics I, II, Environment Protection

Rules of integrated grade setting

Integrated grade is calculated from the formula: 0.5L + 0.3T+0.2HA, where L is final lectures grade, T is tests grade, HA denotes for home works and active participation.

Recommended readings

1. Probability and statistics ebook.
http://wiki.stat.ucla.edu/socr/index.php/Probability_and_statistics_EBook
2. Electronic Version): StatSoft, Inc. (2007). Electronic Statistics Textbook. Tulsa, StatSoft. WEB: http://www.statsoft.com/textbook/stathome.html.
3. Statistics: An Introduction by Roger E. Kirk. (Wadsworth Publishing Company)
4. Environmental Statistics Methods and Applications by Vic Barnett (Wiley Series in Probability and Statistics)
4. Using Statistics to Understand the Environment (Routledge Introductions to Environment Series) (Paperback) by Penny A. Cook.

Contents of lectures (syllabus)

	Topics	Time (hrs.)	Scope (S / Ex)
1	Main statistical concepts. Descriptive statistics. Main features of environmental data. Statistical tables and graphs.	2	S
2	Probability, random variables, main types probability distributions of environmental data. Expectation and standard deviation of probability distribution.	2	S
3	Point estimation. General concepts. Methods of point estimation. Examples illustrating the importance of appropriate point estimation in environmental science.	1	S
4	Confidence intervals based on a single sample. Basic properties and interpretation. Confidence intervals for the mean, standard deviation, and proportion of a normal population. Large-sample confidence intervals. Bootstrap confidence intervals. Determining the required sample size. Environmental applications.	2	S
5	Statistical hypotheses and test procedures based on a single sample and two samples. Tests concerning a population mean, proportion and variance.	2	S
6	Simple linear regression model. Interferences about model parameters: a confidence interval and hypothesis-testing procedures. The Pearson's and Spearman's correlation coefficients. Remarks on prediction problems and on non-linear regression.	2	S
7	Introduction to the analysis of variance (ANOVA).	2	S
8	Statistical inference for frequency data. Pearson's χ^2 test for goodness of fit.	1	S
9	Examples of distribution-free statistical procedures. Remarks on their role in environmental applications.	1	Ex
	Total	**15**	**hours**

S – topics listed in the legal study programme standards from 12.07.2007
Ex – extended topics

Lecturers

Prof. nzw. dr hab. inż. Jarosław Zawadzki

Assessment method

Final test

Contents of tutorials

	Topics	**Time** (hrs.)	**Scope** (S / Ex)
1	An examples of descriptive statistics use for environmental data analysing, summarizing and displaying.	2	S
2	Probability distributions and point estimation procedures common in environmental problems. The calculation of expectation and standard deviation of probability distribution.	2	S
3	Environmental applications (e.g. geochemical, geophysical) of statistical intervals and statistical hypotheses.	3	S
4	Regression and correlation analyses of bivariate data. Applications in soil pollution studies, remote sensing, forestry etc.	2	S
5	Environmental sampling design. Introduction to geostatistics.	2	Ex
6	The use analysis of variance in environmental investigations illustrated by a environmental of examples and exercises.	2	S
7	The importance of distribution-free procedures for environmental studies – examples, e.g. principles of Monte Carlo risk assessment.	2	Ex
	Total	**15**	**hours**

S – topics listed in the legal study programme standards from 12.07.2007
Ex – extended topics

Persons responsible for tutorials

Prof. dr hab. inż. Jarosław Zawadzki

Assessment method for tutorials

Tests, home works and active participation.