Course name : **Statistical linear models and their applications**		
Type of study: **Informatics and/or mathematics**	Type of study: **Full-time**	Examination: **Assignment**
Course characteristics: **Compulsory**	Level: **B.Sc.**	Year: **Full year**
Type of classes: **lectures, tutorials**	Hours per week: **2 lect, 2 tut**	ECTS points: **5 ECTS**

COURSE GUIDE

COURSE OBJECTIVE

C1. To provide students with mathematical foundation to linear regression modelling

C2. To present various real-world applications of this abstract mathematical theory.

C3. To equip students with knowledge which is sufficient to recognize and assess archetypal modelling situations in complicated real-world settings.

PREREQUISITES

1. Course of elementary algebra, in particular matrix calculus.
2. Course of the calculus of one and several variables (course of the mathematical analysis).
3. Fundamental knowledge about probability theory and basics of statistical inference
4. Ability to work independently and in a group.
5. Ability to correctly interpret and present their own activities.

LEARNING OUTCOMES

L 1 – student is familiar with the mathematical theory of statistical linear models and its extensions

L 2 – student is able to independently formulate and solve basic real-world regression modeling problems,

L 3 – student is able to use any developed regression model in order to describe various features of the underlying real-world phenomenon.

CONTENT

Lectures	**Hours**
1. Introductory mathematics – some facts and terminology (Matrix manipulations, quadratic forms, s-fields, measurable functions, probability basics, random vectors and their distributions)	**6**
2. Conditional expectations. Regression.	**4**
3. Linear regression models - The least squares theory.	**4**
4. Linear regression models – verification and validation.	**4**
5. Regression analysis – other approaches (Least absolute deviations, ridge regression, Bayes approach, min-max approach, other approaches)	**2**
6. Regression modelling practice – linear models vs. data in hand	**4**
7. Regression modelling practice – nonlinear models	**4**

8. Modelling of economic and industrial problems: case studies	**2**
TUTORIALS	Hours
1. Linear Algebra	**2**
2. Basic probability theory	**2**
3. Statistical inference basics	**2**
4. Measure theory in practice	**2**
5. Conditional expectations calculus	**2**
6. Least squares estimators	**2**
7. Testing hypothesis about the model restrictions	**4**
8. Testing hypothesis about assumptions	**4**
9. Data analysis: Outliers and leverage points	**2**
10. Alternative methods of regression modelling.	**4**
11. Nonlinear models	**4**

DIDACTIC RESOURSES, TEACHING METHODS and LEARNING ACTIVITIES

1. Multimedia presentations
2. Electronic lecture notes
3. Problem sets for students
4. Traditional face-to-face, blackboard supported tutorials
5. Computer packages for statistical modelling (*Maple*, *Statistica*)

LITERATURE

Lecture Notes.
Rao C.R. Linear Statistical Inference and its applications, Wiley, 1972_
Rao C.R., H.Toutenberg. Linear Models. Least Squares and Alternatives, Springer, 1999
Rawlings J.O., Pantula, S.G. , Dickey D.A.. Applied Regression Analysis. A Research Tool, Springer, 2001
Frees E.W., Data analysis using regression models - the business perspective, Prentice-Hall Inc., 1996
Greene W. H. Econometric Analysis, Prentice Hall; 2002.

TEACHERS

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ADDITIONAL NOTES

Links to course unit teaching materials can be found on the http://www.pcz.pl/english/ects-subjects website for current students.