

Course name : <b>Statistics and econometrics</b>		
Type of study: <b>Mathematics</b>	Type of study: <b>Full-time</b>	Examination: <b>Exam</b>
Course characteristics: <b>Compulsory</b>	Level: <b>First (B.Sc.)</b>	Year: <b>Autumn Semester</b>
Type of classes: <b>lectures, laboratory</b>	Hours per week: <b>2 L, 2 Lab</b>	ECTS points: <b>6 ECTS</b>

## **COURSE DESCRIPTION**

### **COURSE OBJECTIVE**

- C1.** To provide students with a foundation to statistical analysis of data and to modelling of statistical relationship between observed phenomena in the uncertain environment.
- C2.** To equip students with basic mathematical concepts and tools that are used to analyze and solve statistical problems and to develop regression models
- C3.** To present various real-world applications of the statistical theory, especially in problems arising in finance, economics and engineering.
- C4.** To equip students with knowledge which is sufficient to recognize and assess archetypal models in complicated real-world settings.

### **PREREQUISITES/ ASSUMED BACKGROUND**

1. Basic probability theory (random variables, their distributions and characteristics), basic linear algebra (matrix operations), general mathematical maturity.

### **TEACHING-LEARNING OUTCOMES and COMPETENCES TO BE ATTAINED**

- LO1.** -The student lists the most important classes of problems resolved on the basis of statistical inference and properly classifies practical problems in order to choose methods for solving them.
- LO2.** - The student verifies statistical hypotheses concerning various practical problems, with particular emphasis on problems appearing in economic ,finance and engineering. The student explains the practical meaning of the obtained results.
- LO3.** - Student lists methods of estimating various parameters of randomness and properly applies them to practical problems in the field of economics and social sciences.
- LO4.** - The student analyzes the data underlying the model's construction. The student properly chooses the methods of regression analysis depending on the nature of the possessed data and modifies the form of the model depending on the results of the verification.

**LO5.** - Student uses a computer package to conduct a comprehensive data analysis, estimation of model parameters and its verification. The student correctly interprets the obtained results; uses the obtained models to analyze relationships between model's variables and to predict the possible values of the dependent variable.

## COURSE CONTENT

<b>Lectures - Topics</b>	<b>Hours</b>
<b>L1</b> – Overview of probability methods - introduction.	<b>2</b>
<b>L2, L3</b> – Fundamentals of probability theory. Random variables, their distributions and characteristics – resume.	<b>4</b>
<b>L4, L5</b> - Estimation theory – estimators and their features.	<b>4</b>
<b>L6</b> – Elements of the general theory of hypothesis testing.	<b>2</b>
<b>L7</b> – Testing hypotheses about distribution's parameters.	<b>2</b>
<b>L8</b> – Regression analysis – simple linear regression model. Least squares method.	<b>2</b>
<b>L9</b> – Steps of the regression model building and its verification. Examples.	<b>2</b>
<b>L10, L11</b> – Multiple linear regression. Case studies.	<b>4</b>
<b>L12, L13</b> – Topics in nonlinear regression. Case studies.	<b>4</b>
<b>L14, L15</b> – Topics in time series analysis and its applications.	<b>4</b>
<b>Σ</b>	<b>30</b>
<b>LABORATORY - Topics</b>	<b>Hours</b>
<b>Lab 1</b> – Introduction to lab. Introduction to the Maple software	<b>1</b>
<b>Lab 2</b> – Matrix operations and data operations with the Maple	<b>2</b>
<b>Lab 3</b> – Random variables and their distributions in the Maple. Generating pseudorandom samples	<b>4</b>
<b>Lab 4</b> – Descriptive statistics – Plotting data, computing and interpreting statistical measures.	<b>4</b>
<b>Lab 5</b> – Point and interval estimation	<b>4</b>
<b>Lab 6</b> – Hypothesis testing	<b>3</b>
<b>Lab 7</b> – Linear regression model building.	<b>4</b>
<b>Lab 8</b> – Nonlinear regression.	<b>4</b>

Lab 9 – Time series analysis	4
$\Sigma$	30

#### TEACHING TOOLS

1. – multimedia presentations
2. – lecture notes
3. – problem sets for students
4. – work with computer algebra systems (lab) plus traditional face-to-face, blackboard supported tutorials

#### RECOMMENDED AND ADDITIONAL BIBLIOGRAPHY

<b>RECOMMENDED readings (all available at various internet book-shops and libraries):</b>
A. Aczel, <i>Complete business statistics</i> , New Delhi: Mc Graw Hill, 2006;
E.W. Frees, <i>Data analysis using regression models - the business perspective</i> , Prentice-Hall Inc., 1996
W. H. Greene, <i>Econometric analysis</i> , Prentice Hall, 2002
Adams P., Smith K., Vyborny R., <i>Introduction to Mathematics with maple</i> , World scientific Publishing Co. Ltd., 2004.
<b>ADDITIONAL readings:</b>
J.O. Rawlings, S.G. Pantula, D.A. Dickey, <i>Applied regression analysis</i> , Springer-Verlag, New York 2001
D. Birkes, Y. Dodge, <i>Alternative methods of regression</i> , Wiley & Sons, New York 1993

#### 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.