Course name : **Probabilistic System Analysis**		
Type of study: **Mathematics**	Type of study: **Full-time**	Examination: **Assignment**
Course characteristics: **Compulsory**	Level: **First (B.Sc.)**	Year: **Spring Semester**
Type of classes: **lectures, laboratory, tutorials**	Hours per week: **2 L, 2 Lab, 1T**	ECTS points: **6 ECTS**

COURSE DESCRIPTION

COURSE OBJECTIVE

C1. Making the students familiar with the elements of the theory and methods of probability useful in engineering problems.
C2. Making the students familiar with the elements of the statistical methods.
C3. Introducing the students into using the computer methods in probability and statistics.

PREREQUISITES/ ASSUMED BACKGROUND

1. Course of the calculus of one variable

LEARNING OUTCOMES and **COMPETENCES TO BE ATTAINED**

LO1. – student is familiar with the basics of probability; student understands the need of probability in statistics.
LO2.– student is familiar with the introductory methods of a point and interval estimation; student is able to use Maple in solving simple estimation problems.
LO3.– student is familiar with the introductory methods of a hypothesis testing; student is able to use Maple in solving problems of this type.

COURSE CONTENT

Lecture - Topics	**Hours**
L 1 – Course introduction. The subject of statistics, the need of probability. Types of data	**2**
L 2 – Methods for describing data	**2**
L 3 – The numerical descriptive measures	**2**
L 4 – The numerical descriptive measures, cont. , random experiment, events, sample spaces	**2**
L 5 – Probability – axioms and properties	**2**
L 6 – Conditional probability, total probability Bayes' theorem	**2**
L 7 – Independence. Introduction to the random variables. Discrete random variables.	**2**
L 8 – Probability distribution for discrete random variable, expected value. Basic discrete distributions.	**2**
L 9 – Continuous random variables. Probability distribution for continuous random variables, expected value. Basic continuous distributions.	**2**
L 10 – Basic continuous distributions cont. Introduction to sampling distributions.	**2**

L 11 – Introduction to sampling distributions cont. The law of large numbers. The central limit theorem.	**2**
L 12 – The point estimation	**2**
L 13 – The confidence intervals	**2**
L 14 – Test of hypothesis: single sample	**2**
L 15 – Test of hypothesis: two samples	**2**
Σ	**30**
Tutorials – Topics	**Hours**
T 1 –Types of data	**1**
T 2 – Graphical description of data	**1**
T 3 – The mode, the arithmetic mean	**1**
T 4 – The range of data. Variance and standard deviation	**1**
T 5 – Variance and standard deviation cont., Interpretation of the standard deviation.	**1**
T 6 – Property of probability, Bayes' rule	**1**
T 7 – Independence	**1**
T 8 – Discrete random variables: calculating the expected value and the standard deviation	**1**
T 9 – Discrete random variables: applications to the real world problems	**1**
T 10 – Continuous random variables: calculating the expected value and the standard deviation	**1**
T 11 – Continuous random variables: applications to the real world problems	**1**
T 12 – Point estimation, maximum likelihood method	**1**
T 13 – A confidence interval for a population mean – a large sample case	**1**
T 14 – Test of hypothesis about a population mean – a large sample case	**1**
T 15 – The power of a test, p-value of a test	**1**
Σ	**15**
Laboratory - Topics	**Hours**
Lab 1 – Review of integration	**2**
Lab 2 – Methods for describing data	**2**
Lab 3 – Calculating numerical descriptive measures	**2**
Lab 4 –Basic combinatorics	**2**
Lab 5 – Classical definition of probability	**2**
Lab 6 – Conditional probability, total probability, Bayes' theorem, independence	**2**
Lab 7 –Discrete random variables.	**2**
Lab 8 – Probability distribution for discrete random variable, expected value.	**2**
Lab 9 – Continuous random variables. Probability distribution for continuous random variables, expected value.	**2**
Lab 10 – Generating pseudorandom numbers	**2**
Lab 11 – Various problems concerning discrete and continuous random variables	**2**
Lab 12 – The point estimation	**2**
Lab 13 – The confidence intervals	**2**
Lab 14 – Test of hypothesis: single sample	**2**
Lab 15 – Test of hypothesis: two samples	**2**
Σ	**30**

TEACHING TOOLS

1. – lecture

2. – tutorials
3. – computer laboratory

RECOMMENDED AND ADDITIONAL BIBLIOGRAPHY

Lecture notes
Ramachandran, K. M., Tsokos.C.P., *Mathematical statistics with applications*, Elsevier Academic Press, 2009
J.T.McLeve, P.G.Benson, *Statistics for business and economics*, Macmillan, London 1988 and later issues

TEACHERS

1. Piotr Puchała, piotr.puchala@im.pcz.pl

ADDITIONAL NOTES

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