(*faculty stamp*)

COURSE DESCRIPTION

1. Course title: PROBABILITY AND STATISTICS	**2. Course code**
3. Validity of course description: 2016/2017	
4. Level of studies: BSc programme	
5. Mode of studies: intramural studies	
6. Field of study: MACROCOURSE	(FACULTY SYMBOL)
7. Profile of studies: general	
8. Programme: All specialities	
9. Semester: 3	
10. Faculty teaching the course: Institute of Automatic Control, Rau1	
11. Course instructor: prof. Joanna Polanska, PhD, DsC	
12. Course classification: programme courses	
13. Course status: compulsory	
14. Language of instruction: English	
15. Pre-requisite qualifications: Algebra and Analytic Geometry	
16. Course objectives: The objective of this course is to give a theoretical basis of probability theory and statistics in very general context and to demonstrate the possible applications of this theory to applied models in system engineering, in operation research, and time series.	

17. Description of learning outcomes:

Nr	Learning outcomes description	Method of assessment	Teaching methods	Learning outcomes reference code
W1	Knows basics of theory of probability	SP	WM, C	T1A_W01
W2	Knows techniques for processing and presentation of statistical data.	SP	WM, C	T1A_W01 T1A_W02
W3	Knows basic concepts from descriptive statistics: measures of location, dispersion, symmetry and concentration.	SP	WM, C	T1A_W01 T1A_W02
W4	Knows methods for constructing estimators and evaluation of their properties	SP	WM, C	T1A_W04 T1A_W09
W5	Knows how to formulate and verify simple statistical hypotheses	SP	WM, C	T1A_W04
W6	Knows methods for measuring correlation between variables	SP	WM, C	T1A_W04
U1	Can perform correct sampling from population and define the type of the variable	PS	WM, C	T1A_U01 T1A_U08
U2	Can propose descriptive statistics for different types of variables and construct point and interval estimators	PS	WM, C	T1A_U03 T1A_U09 T1A_U15
U3	Can perform statistical inference in one dimensional data space	PS	WM, C	T1A_U03 T1A_U09
U4	Can verify hypotheses about correlation between variables	PS	WM, C	T1A_U03 T1A_U09
U5	Can use Excel and Matlab software to support statistical analysis of data	PS	WM, C	T1A_U02
K1	Can make his own decisions about the best solutions	PS	WM, C	T1A_K01 T1A_K06
K2	Can present and defend the proposed solution	OS	WM, C	T1A_K04 T1A_K05

K3	Can interact and work in a group assuming different roles	CL	WM, C	T1A_K03

18. Teaching modes and hours

Lecture : 30 Laboratory: 30

19. Syllabus description:

The course consists of two parts: probability theory and applied statistics. The probability part starts with set theoretic concepts such as sigma-algebras, and denumerable operations on sets. Then, probability is introduced as a denumerably additive nonnegative normed set function. Properties of probabilities, including conditional probability follow. Random variables are introduced as measurable maps from the probability space in to the set of real numbers with Borel sigma-algebra. Distribution functions are discussed, including important examples of continuous and discrete distributions binomial/Poisson, geometric, uniform, exponential, normal, multivariate normal, gamma and chisquare). Independence of events is shown to lead to strong results such as Borel-Cantelli theorems and Kolmogorov 0-1 law. Expected values are defined as Lebesgue integrals of random variables. Monotone and Dominated Convergence theorems follow. Law of Large Numbers and Central Limit Theorem are discussed.
The second part starts with the survey of the methods of basic statistical testing where special emphasis is put on the hypothesis tests for the mean and variance of a normal population. Then the nonparametric methods are introduced followed by the ANOVA algorithms. Next we focus on the way of describing the relations among random variables. We introduce the measures of correlation (for both Gaussian and non – Gaussian random variables) and basic statistical tests. We give a general introduction to linear regression and consider the estimation problem for unknown parameters of probability distribution. Here we discuss the following three main methods: maximum likelihood method, the least squares method and the method of moments. Finally we present the basis of the analysis of frequencies.
All the theoretical material is broadly illustrated by the examples whose purpose is to help understanding the theoretical concepts and to show the possibility of applications of the probability methods in engineering practice

Lectures and laboratory topics:

1. Probability theory, part 1 – total and conditional probability
2. Probability theory, part 2 – distribution functions
3. Descriptive statistics
4. Graphical representation
5. Elements of theory of estimation. Point and interval estimators
6. Parametric tests, part 1 – testing for population mean,
7. Parametric tests, part 2 – testing for population variance
8. Goodness of fit tests
9. Nonparametric tests - unpaired measurements
10. Nonparametric tests – paired measurements
11. Inference for proportions – testing for population proportion
12. Inference for proportions – odds ratio, test of independence
13. Measures of correlation, linear regression

20. Examination: no

21. Primary sources:

1. Feller W: An Introduction to Probability Theory and Its Applications, Vol. 1, Wiley, 3rd edition or later
2. Sokal RR, Rohlf JF: Biometry WH Freeman, 3rd edition or later
3. Zar JH: Biostatistical Analysis, Prentice Hall, 4rd edition or later

22. Secondary sources:

1. J. Koronacki, J. Mielniczuk: Statystyka dla studentów kierunków technicznych i przyrodniczych, WNT Warszawa 2001

2. J. Greń: Modele i zadania statystyki matematycznej. PWN Warszawa 1970

23. Total workload required to achieve learning outcomes

Lp.	Teaching mode :	Contact hours / Student workload hours
1	Lecture	30/10
2	Classes	0/0
3	Laboratory	30/30
4	Project	0/0
5	BA/ MA Seminar	0/0
6	Other	10/10
	Total number of hours	70/50

24. Total hours:120

25. Number of ECTS credits: 5
26. Number of ECTS credits allocated for contact hours: 5
27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects): 3
26. Comments:

Approved:

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(date, Instructor's signature) (*date , the Director of the Faculty Unit signature)*