STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Mathematics**			Code **1010805111010340001**
Field of study **Electronics and Telecommunications**	Profile of study (general academic, practical) **general academic**		Year /Semester **1 / 1**
Elective path/specialty **-**	Subject offered in: **Polish**		Course (compulsory, elective) **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time) **part-time**		
No. of hours Lecture: **60** Classes: **30** Laboratory: **-** Project/seminars: **-**			No. of credits **8**
Status of the course in the study program (Basic, major, other) **basic**	(university-wide, from another field) **university-wide**		
Education areas and fields of science and art **technical sciences** **Technical sciences**			ECTS distribution (number and %) **8 100%** **8 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	- vector nad matrix algebra, - calculus, - ODE1 and ODE2 with constant coefficients, - probability and descriptive statistics (all items within the scope defined for the education at the first cycle of the tertiary studies)
2	**Skills**	logical reasoning, correct use of the concepts a student met, appropriate application of the mathematical apparatus
3	**Social competencies**	the incomplete knowledge of self-awareness and the need for further the awareness of lacks in the knowledge and, in consequence, the need for further education

Assumptions and objectives of the course:

Presentation of selected topics (and their applications in description and analysis of technical phenomena, especially occurring in electronics and telecommunications) in the following sections:

- linear and abstract algebra (incl. groups and linear spaces),
- differential equations,
- inferential statistics

after the regulation defined by the ministry of Science and Higher Education issued on 12th of July, 2007 r. (Standardy kształcenia dla kierunku studiów:Elektronika i telekomunikacja), http://www.bg.pw.edu.pl/akty_prawne/elektronika_i_telekomunikacja.pdf (acc.2010-03-02); Dziennik Ustaw nr 164, poz.1166, zał. nr 23) 2013-11-28}

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. an expanded and deepened knowledge in mathematics which is (or can be) useful for formulating and solving problems considered in electronics and telecommunications (eg., in the digital signal processing - including that via satellites, in the information theory and the coding theory, in the network engineering and the network systems, in the theory of the telecommunication networks - [K2_W00; K2_W05, K2_W09, K2_W11, K2_W13]

Skills:

1. an acquisition of information from books, journals, the Internet (also in English), their integration with the knowledge already acquired as well as their interpretation - [K2_U01]

2. a clear description of the task (also in case when it is of scientific character) and its concise presentation - [K2_U02]

3. a willingness to apply the methods and mathematical models for analysis, design and optimization of devices and telecommunication systems - [K2_U05]

Social competencies:

1. an awarness that my knowledge (as well as that possesed by others) is incomplete, an awareness of their own ineptitude and others aware of the need for further training in thoery and in practical skills - [K2_K04]

2. an awareness of the necessity of a professional approach to the problems (also at the stage of theoretical framework, where mathematics plays an important role), also an awareness that I have to be responsibie for their proposed solutions - [K2_K05]

3. an understanding of the role the country plays in the development of the information society - [K2_K02]

Assessment methods of study outcomes

Control questions during classes.

Individually elaborated presentation of topics specified by the teacher.

Three written tests (checking the skills acquired in every of three lectured sections), and the make-up test if necessary.

The final exam (in written form at the first attempt, in written and oral form at the retake date).

Course description

A1) Repertory in vector and matrix analysis.

A2) Matrix eigenproblem.

A3) Basic algebraic structures: groups, rings and fields, linear spaces.

A4) Normed, Banach, unitary and Hilbert spaces.

R1) Repertory in ODE1 and in linear ODE2 with constant coefficients.

R2) Linear ordinary differential equations of an arbitrary order and their systems.

R3) Nonlinear ODE, e.g., Legendre, Bessel and Airy equations.

R4) PDE1.

R5) PDE2.

S1) Repertory in combinatorics, in the probability (incl. classical and geometrical probabilities) and in the descriptive statistics.

S2) Bertrand paradox and axiomatic probability after A.Kolmogorov.

S3) A random variable, its density and cdf, expected value and standard deviation.

S4) Basic discrete distributions, incl. Bernoulli, binominal, geometryical, Poisson.

S5) Basic continuous distributions, incl. triangular, Gaussian, chi-squared, Student, Weibull (and its particular cases: exponential, Rayleigh), Erlang and gamma.

S5) Laws of large numbers and CLT.

S6) The point estimation (incl. MVUE, ML) and the interval estimation (confidence intervals, Bayes confidence interval).

S7) Parametric hypothesis tests (for the mean, for the variance, for the ratio structure.)

S8) Non-parametric hypothesis tests (chi-squared, Kolmogorov, Wald-Wolfowitz)

S9) The analysis of variance (ANOVA) and F Snedecor, Bartlet, Brown-Forsythe, Levene tests.

S10) Stochastic processes: Markov, Poisson, Gauss, Wiener (a.k.a. Brown motion).

Basic bibliography:

1. Y.Dodge - The concise encyclopedia of statistics, Springer 2008

2. W.Kołodziej - Analiza matematyczna, PWN 1967 (and later editions)

3. A.D.Polyanin - Handbook of partial differentail equations for engineers and scientists, Chapman & Hall 2002

4. J.Szabatin - Podstawy teorii sygnałów, WKL 2000

Additional bibliography:

1. D. Bobrowski, Probabilistyka w zastosowaniach technicznych, WNT, Warszawa, 1986
2. P.K.Bora - EC622 Statistical signal processing, IIT Guwahati 2008
3. Dekking et al. - A modern introduction to probability and statistics, Springer 2005
4. M.Liskowski, Podstawy statystyki praktycznej, WSHiG Poznań 2003
5. S.Łanowy i in. - Równania różniczkowe, WPŚ Gliwice 2000
6. G.Łysik - Równania różniczkowe zwyczajne, UH-P Kielce 2009; G.Łysik - Równania różniczkowe cząstkowe, UH-P Kielce 2009
7. A.Martlewski - Algebra i teoria grafów dla studentów politechnik, WPP Poznań 1989, 1991
8. A.Marlewski, Algebra macierzy liczbowych, NAKOM Poznań 2010
9. W.Oniszczuk - Metody modelowania, WPB Białystok 1995
10. R.L.Ramey, E.J.White - Zastosowanie macierzy w maszynowej analizie układów elektronicznych, PWN 1974

Result of average student's workload

Activity	Time (working hours)
1. the participation in classes and lectures, the examination passing	94
2. the reading the lecture content, the individual work	143
3. the invidual consultation with the teacher	3

Student's workload

Source of workload	hours	ECTS
Total workload	200	8
Contact hours	97	4
Practical activities	80	3