STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Applied mathematics and mathematical methods**		Code **1010605211010343531**
Field of study **Transport**	Profile of study (general academic, practical) **(brak)**	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: **16** Classes: **14** Laboratory: **-** Project/seminars: **-**		No. of credits **3**
Status of the course in the study program (Basic, major, other) **(brak)**	(university-wide, from another field) **(brak)**	
Education areas and fields of science and art **the sciences** **Mathematical sciences**		ECTS distribution (number and %) **3 100%** **3 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	student knows, within the scope embraced by the mathematical training at the first-cycle studies, the concepts and techniques in matrix algebra, in differential and integral calculus, in linear ordinary differential equations, in probability and statistics
2	**Skills**	student knows how to 1) solve arbitrary systems of linear algebraic equations, 2) calculate derivatives and simple integrals, 3) obtain analytical solutions to basic ordinary differential equations
3	**Social competencies**	student 1) is aware of the importance of mathematics in the description of scientific and engineering problems, 2) understands the need for learning

Assumptions and objectives of the course:

1) to familiarize students with the terminology and methods of higher mathematics presented in the course at hand,

2) to show they to see how presented topics are applied to exemplary problems discussed in engineering sciences

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

Knowledge:

1. An extended knowledge of applied mathematics and mathematical methods in transport, including: - [K2A_W01]

2. numbers and functions (including their sequences and series, also in complex domain), calculus in one and several variables, , exemplary non-linear ordinary, as well as linear partial, differential equations, practical probability and statistics, mathematical decision support methods, game theory elements - [K2A_W01]

Skills:

1. An ability to find information in literature, internet, databases and other sources (in Polish and English), - [K1A_01]

2. A critical evaluation of results obtained in theoretical considerations and in calculations, incl. these produced by computers - [K1A_U18]

3. An art of preparation and delivering (in Polish and English) a verbal and multimedia presentation of trained subjects - [K1A_U05]

Social competencies:

1. The awareness of the importance of lifelong learning, also in mathematics (for the mathematics is the necessary language to describe technical devices and processes, hence in the high-tech world an engineer who does not dominate basic mathematics can not be conscious, and, in consequence, (s)he can not be creative) - [K2A_K01]
2. The awareness and understanding of the importance the mathematical education has in the professional activity (in particular, in technical and financial aspects, in short- and long-time horizon). - [-]

Assessment methods of study outcomes

Marks which are issued during classes (realized in a traditional way, with a chalk and blackboard) and given to homeworks (they may be prepared with computer assistance). Lectures are evaluated via final check; this is done in normal mode in written form, and in re-sit mode it can be also orally if a student is hopefully to bring a positive evaluation.

Course description

Analytical geometry with elements of variational calculus (e.g. involute, brachistochrone, tautochrone, catenary and catenoid).

2. Nonlinear ordinary differential equations (e.g., Legendre, Chebyshev, Laguerre, Hermite, Airy, Bessel equations, pendulum equation).

3. Basic partial difference equations (2-dimensional wave, heat, Laplace equations).

4. Exemplary difference and differential equations (Lotka-Volterra system).

5. Mathematical methods for decision support

(a.o. minimax and Bayesian ones, optimization of decision functions).

6. Game theory (2- and many-player games, non- and cooperative games, games with non-complete information, zero-sum games, Pareto optimalty, Nash optimality).

Because of the number of teaching hours almost all topics will be presented in condensed form (so the course is really introductory); appr. 4, 5, 5, 4, 4 and 4 hours, resp.(they sum to 26 hours, last 4 hours of the lectures are to do final tests).

Course content is prepared after rozporządzenie MNiSW z 12 lipca 2007 r., zał. nr 7 (Standardy kształcenia dla kierunku studiów: Transport), http://www.bip.nauka.gov.pl/_gAllery/24/24/2424/107_transport.pdf (accessed on 2010-03-02, 2012-09-20); Dziennik Ustaw nr 164, poz.1166

Basic bibliography:

1. N.W.McLachlan, Równania różniczkowe zwyczajne nieliniowe w fizyce i naukach technicznych, PWN 1964

2. M.Majchrowski, Równania różniczkowe cząstkowe i ich zastosowania, Politechnika Warszawska, http://alpha.mini.pw.edu.pl/~mm/konw/ (2012-09-20)

3. S.B.Leble, Równania różniczkowe i całkowe w fizyce i technice, Politechnika Gdańska, http://www.mif.pg.gda.pl/krrizm/page/leble/scrypt_rric.pdf (2012-09-20)

4. S.Łanowy i in., Równania różniczkowe, Politechnika Śląska Gliwice 2000 http://lucc.pl/inf/row_rozniczkowe/lanowy_przybylak_szlek_-_rownania_rozniczkowe.pdf (2012-09-20)

5. Nung Son Nguyen, Systemy decyzyjne, Uniwersytet Warszawski 2012, http://mst.mimuw.edu.pl/wyklady/syd/wyklad.pdf (2012-09-20)

6. T.Płatkowski, Wstęp do teorii gier, Uniwersytet Warszawski 2012, http://mst.mimuw.edu.pl/wyklady/wtg/wyklad.pdf (2012-09-20)

Additional bibliography:

1. J.Morchało i in., Równania różniczkowe zwyczajne w zastosowaniach, PP Poznań 1990

2. B.Żółtowski, S.Niziński, Modelowanie procesów eksploatacji maszyn, ATR Bydgoszcz 2002

3. J.Mikielewicz, Zasady formułowania modeli matematycznych zjawisk cieplno-przepływowych, Biul.ITC PW 84,1996, 15 stron, http://papers.itc.pw.edu.pl/index.php/JPT/article/view/29/31 (2012-09-20)

4. R.A.Struble, Równania różniczkowe nieliniowe, PWN 1965

5. D.N.Chorafas, Procesy ststystyczne I niezawodność urządzeń, WNT 1963

6. A.Iwasiewicz, Statystyczna kontrola jakości w toku produkcji, PWN 1985

Result of average student's workload

Activity	Time (working hours)
1. listening to lectures, participation in classes	50
2. self-study and preparation of reports	40

Student's workload

Source of workload	hours	ECTS
Total workload	90	3
Contact hours	45	2
Practical activities	10	1