{ KARTA OPISU MODUŁU KSZTAŁCENIA } **Training module description form**

Name of the module/subject	Code
Applied mathematics and mathematical methods	**1010602311010343531**

Fidel of study	Education profile	Year / Semester
Machines and Transportation	**general academic**	**1 / 1**

Specialization area	Lecturing language:	Type of the course:
Gas Technology, Product Engineering	**polski**	**obligatoryjny**

Study llevel:	**Study form**
II level	**stationary**

Hours	Scores:
Lectures: **1** Lectures: **1** Laboratories **-** Projects/seminars: **-**	**3**

Status in the study programme:	(ogólnouczelniany, z innego kierunku)
basic	**general academic**

Fidel(s) of training, area(s) of scence and arts:	**ECTS (number and %)**
exact sciences	**100%**

Lecturer:

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Wymagania wstępne w zakresie wiedzy, umiejętności, kompetencji społecznych:

1	Knowledge:	Higher mathematics trained in the first course.
2	Skills:	An applying of theorems of mathematical analysis, linear algebra and the theory of differential equations to calculate limits, derivatives and integrals, to solve sales, to find solutions to LODE1 and LODE2 with constant coefficients
3	Social competence	Awareness in the need the knowledge and practical skills has to be deepened and expanded

Aim of the course:

A look on modelling and the earning the mathematical methods (both theoretical and practical ones) which are used in engineering, in particular in applied mechanics.

Efects:

Knowledge:

Deepened and expanded knowledge in mathematics, up to be used in understanding and formulation of problems considered in mechanics, managing and related areas

[[K2_W00]], [[K2_W03]], [[K2_W05]]

Skills:

Reading of mathematical formulae and texts, their adaptation to real-world problems, as well as the ability to model real-world problems - [[K2_U05]], [[K2_U09]]

Communication in written and spoken English on professional matters, in particular efficient reading of English texts (books, technical and scientific journals, application notes, catalogs, manuals) - [[K2_U01]]

Social competence:

1. The understanding the role played by engineers in the development of the country - [[K2_K02]]

2. An awareness that there are needed a reliable approach to problems treated in professional activity and an undertaking the responsibility for the proposed technical solutions. - [[K2_K05]]

Ways to check the effects of education

Classes. Activity in classes, written elaboration of the assigned task (e.g.. determination of the mean square polynomial fit, calculating the eigenvalues and eigenvectors, solving the differential equation).
Lectures. Final exam.

Contents of the course

1. General view on mathematics: maths as a separate, non-physical world, mathematical logics and the set theory, an equivalence relation and a function.
2. Complex functions.
3. Integral and discrete Fourier transformations. Fourier polynomials and series.
4. Repetition and extension of knowledge in linear algebra: an inner product of vectors (and its realization via Pearson correlation coef.); a system of algebraic linear equations (sale) and its condition number, a polynomial collocation and a least-square fit; a vector product of vectors; additive and multiplicative decomposition of matrices (A=L+D+U, A=LU, A=QR); algebraic/matrix eigenproblem; singular values.
5. Matrix exponential, exp(A), and system w'=Aw+b
6. Metric space, linear space, norm space, unitary space, Hilbert space, Banach space.
7. Repetition on ordinary differential equation (ODE). Basic numerical methods for ODE.
8. Linear partial differential equation (PDE): recognition of the type of PDE2; exact/analytic and approximate/numerical solutions to parabolic, hyperbolic and elliptic PDEs.
9. Linear and nonlinear difference equation (incl. logistic difference eqn, Lotke-Volterra system).

Basic literature:

1973 Daniel P. Maki, Maynard Thompson – *Mathematical models and applications*, Prentice-Hall.
1985 R.L. Burden, J.D. Faires – *Numerical analysis*, Prindle, Weber & Schmidt.
1999 Carmen Chicone – *Ordinary differential equations with applications*, Springer.
2004 Lloyd Jaisingh, Frank Ayres – *Schaum's outline of theory and problems of abstract algebra*, McGraw-Hill.
2004 Sam Howison – *Practical applied mathematics. Modelling, analysis, approximation*. Cambridge University Press.
2005 Paul Cull, Mary Flahive, Robby Robson – *Difference equations. From rabbits to chaos*, Sprinter.
2007 2007 Xin-She Yang – *Applied engineering mathematics*, Cambridge International Science Publishing
2007 Peter Markowich – *Applied partial differential equations. A visual approach*. Springer
2007 Robert Watts – *Essentials of applied mathematics for scientists and engineers*, Morgan & Clay Publishers
2007 M.Soare, P. P.Teodorescu, I. Toma – *Ordinary differential equations with applications to mechanics*, Springer.
2009 Ravi P. Agarwal, Donal O'Regan – *Ordinary and partial differential equations with special functions, Fourier series and boundary value problems*, Springer.
2015 Thomas Judson – *Abstract algebra. Theory and applications*, Orthogonal Publishing.

Additional sources:

1964 N.W.McLachlan – *Równania różniczkowe zwyczajne nieliniowe w fizyce i naukach technicznych*, PWN.
1982 W.Kołodziej – *Wybrane rozdziały analizy matematycznej*, PWN (wyd.2).
1991 A.Marlewski – *Algebra i teoria grafów dla studentów politechnik*, Wydawnictwo Politechniki Poznańskiej.
2007 A.R. Heesterman (ed.) – *Handbook of linear algebra*, Chapman & Hall.
2008 A.Marlewski – *Podstawowe metody numeryczne dla studentów kierunków inżynierskich*, PWSZ Piła 2008

Bilans nakładu pracy przeciętnego studenta

Czynność	Czas (godz.)
1. udział w wykładach i ćwiczeniach oraz podczas egzaminu, zasięganie konsultacji	50
2. opracowanie zadania zaliczeniowego, studiowanie materiału wykładowego i przygotowanie się do egzaminu	40

Obciążenie pracą studenta

forma aktywności	godzin	ECTS
Łączny nakład pracy	90	3
Zajęcia wymagające bezpośredniego kontaktu z nauczycielem	45	0
Zajęcia o charakterze praktycznym	10	0