Zał. nr 4 do ZW 64/2012

FACULTY OF PURE AND APPLIED MATHEMATICS
SUBJECT CARD

Name in Polish: Równania różniczkowe cząstkowe z zastosowaniami w przemyśle
Name in English: Partial differential equations with applications in industry
Main field of study (if applicable):Applied Mathematics
Specialization (if applicable): Mathematics for Industry and Commerce
Level and form of studies: ~~1st/~~ 2nd* level, full-time / ~~part-time~~*
Kind of subject: obligatory~~-~~/ ~~optional~~ / ~~university-wide~~*
Subject code MAP2040
Group of courses YES / ~~NO~~*

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30	30			
Number of hours of total student workload (CNPS)	90	90			
Form of crediting	Examination / crediting with grade*	Examination / crediting with grade*	Examination / crediting with grade*	Examination / crediting with grade*	Examination / crediting with grade*
For group of courses mark (X) final course	X				
Number of ECTS points	3	3			
including number of ECTS points for practical (P) classes	1	3			
including number of ECTS points for direct teacher-student contact (BK) classes	2	2			

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student knows and can apply classical notions and methods of real and complex analysis.
2. Student knows and can apply elementary notions and methods of ordinary differential equations.

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SUBJECT OBJECTIVES

C1 Study of basic notions and acquisition of knowledge in the area of differential equations.
C2 Study of basic applications of partial differential equations in science, technology and industry.
C3 Acquisition of basic abilities in mathematical modelling by partial differential equations.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge the student:

PEK_W01 knows the most important theorems from main areas of differential equations

PEK_W02 knows basics of modelling by differential equations in technology and natural sciences, especially in physics, chemistry and biology.

relating to skills the student:

PEK_U01 can analyze basic problems of differential equations,

PEK_U02 can construct mathematical models with the usage of differential equations in concrete applications of mathematics.

relating to social competences the student:

PEK_K01 can, without assistance, search for necessary information in the literature, also in foreign languages

PEK_K02 understands necessity of systematic and individual work on the material of the course.

PROGRAMME CONTENT

Form of classes - lecture		**Number of hours**
Lec1	A reminder of information concerning first order partial differential equations. Methods of characteristics, weak solutions and shock waves.	4
Lec2	Second order partial differential equations and their classification. Physical motivations.	2
Lec3	Parabolic equations and their applications (heat, diffusion). Initial-boundary problems, method of separation of variables, Fourier transform, fundamental solution, maximum principle.	8
Lec4	Hyperbolic equations and their applications (vibration of strings, membranes and beams; acoustical, mechanical and electromagnetic waves). D'Alembert's solution, initial-boundary problems, method of separation of variables, Kirchhoff's solution, Huygens' principle.	8
Lec5	Elliptic equations and their applications (stationary temperature distribution, gravitational and electrostatic potential). Boundary value problems, eigenfunctions, Poisson's equation, Green's function.	6
Lec6	The calculus of variations and its applications. Euler-Lagrange equation, Lagrangian mechanics, geodesic equation, minimal surface equation.	2
	Total hours	**30**

Form of classes - Class		**Number of hours**
Cl1	Solving of problems for differential equations and their applications.	**30**
	Total hours	**30**

TEACHING TOOLS USED

N1. Lecture – traditional method

N2. Tutorial class

N3. Consultations

N4. Student’s personal work – preparation for the laboratory

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1	PEK_W01 PEK_W02 PEK_K01	exam
F2	PEK_U01 PEK_U02 PEK_K01	Oral presentations, tests, written reports.
P=0.5*F1+0.5*F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] S.J.Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993.

[2] R.Haberman, Applied Partial Differential Equations with Fourier Series and Boundary Value Problems, Pearson, 2012.

[3] A. N. Tichonow, A. A. Samarski, Równania fizyki matematycznej, PWN 1963.

SECONDARY LITERATURE:

[1] J. Ockendon, S. Howison, A. Lacey & A. Movchan, Applied Partial Differential Equations, Oxford University Press, Oxford 1999.

[2] L. C. Evans, Równania różniczkowe cząstkowe, PWN 2002.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
DIFFERENTIAL EQUATIONS MAP1900
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
MATHEMATICS
AND SPECIALIZATION

MATHEMATICS FOR INDUSTRY AND COMMERCE

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)**	Subject objectives***	Programme content***	Teaching tool number***
PEK_W01 (knowledge)	K2MIC_W03	C1-C3	Lec1-Lec15	1, 3
PEK_W02	K2MIC_W07	C1-C3	Lec1-Lec15	1, 3
PEK_U01 (skills)	K2MIC_U15	C1-C3	Cl1	2, 3, 4
PEK_U02	K2MIC_U16	C1-C3	Cl1	2, 3, 4
PEK_K01 (competences)	K2MIC_K06	C1-C3	Lec1-Lec15 Cl1	1, 2, 3, 4
PEK_K02	K2MIC_K01	C1-C3	Lec1-Lec15 Cl1	1, 2, 3, 4

** - enter symbols for main-field-of-study/specialization educational effects
*** - from table above