Zał. nr 4 do ZW 64/2012

FACULTY OF PURE AND APPLIED MATHEMATICS
SUBJECT CARD

Name in Polish: Teoria gier i jej zastosowania
Name in English: Game theory and applications
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 MAT1554
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		60		
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		2		
including number of ECTS points for practical (P) classes			2		
including number of ECTS points for direct teacher-student contact (BK) classes	1,5		1,5		

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student knows and can apply basic concepts, theorems and methods of the mathematical analysis, probability theory and theory of stochastic processes.

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SUBJECT OBJECTIVES

C1 Study of concept of non-cooperative game and Nash equilibrium, as well as basic theorems that concerns an existence of Nash equilibrium.

C2 Study of classical methods for solving strategic-form games.

C3 Acquisition of ability to solve simple extensive-form games.

C4 Study of basics of dynamic game theory and acquisition of ability to solve them.

C5 Study of dynamic programming methods.

C6 Application of acquired knowledge to create and analyze mathematical models in order

to solve theoretical and practical problems in various field of science and technology.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 knows the most important concepts of non-cooperative game theory, in particular, idea of Nash equilibrium, correlated equilibrium and bayesian equlibrium, as well as, basic theorems that concern existence and methods of finding those equlibriums.

PEK_W02 knows the basic concepts of dynamic game theory, in particular the idea of perfect equilibrium.

PEK_W03 knows the basic concepts of dynamic programming.

PEK_W04 knows the key applications of game theory models in economy.

relating to skills:

PEK_U01 can find Nash equlibriums, correlated equilibriums and bayesian for simple non-cooperative games.

PEK_U02 can formulate appropriate optimization problems, leading to finding game value and optimal strategies for zero-sum games.

PEK_U03 can reformulate finite dynamic games as stategic-form games and can solve them.

PEK_U04 can use dynamic programming in order to find game value and optimal strategies in simple dynamic games.

relating to social competences:

PEK_K01 can use science literature.

PEK_K02 can be the responsible person and acquire knowledge in a fair manner.

PEK_K03 understands the need for systematic and independent work on the mastery of the course material.

PEK_K04 respects the customs and rules of the academic environment.

PROGRAMME CONTENT

Form of classes - lecture		**Number of hours**
Lec 1	History of game theory, Prisoner's dilemma, Pareto optimal solutions. Normal-form games, algorithm for eliminating dominated strategies, Nash equilibrium.	4
Lec 2	Nash's theorem vs Brouwer's theorem.	2
Lec 3	Zero-sum games, von Neumann's minimaks theorem. Linear programming.	2
Lec 4	Extensive-form games, Kuhn's theorem, perfect equilibrium in subgame.	2

Lec 5	Behavior strategies vs mixed strategies in extensive-form games.	2
Lec 6	Correlated equilibria and bayesian equilibria.	4
Lec 7	Cournot and Bertrand models, Stackelberg equilibrium.	4
Lec 8	Infinite dynamic games.	4
Lec 9	Introduction to stochastic games.	2
Lec 10	Dynamic programming.	2
Lec 11	Usage of dynamic programming to analyze simple games.	2
	Total hours	30

Form of classes - laboratory		**Number of hours**
Lab 1	Normal-form games. Nash equilibrium.	6
Lab 2	Linear programming. Exstensive-form games.	4
Lab 3	Bayesian equilibrium.	4
Lab 4	Cournot and Bertrand models and Stackelberg solutions.	2
Lab 5	Games with continuous set of strategies.	2
Lab 6	Auctions.	2
Lab 7	Infinite dynamic games.	4
Lab 8	Stochastic games.	2
Lab 9	Lab with problem solving.	4
	Total hours	30

TEACHING TOOLS USED

N1. Lecture – traditional method
N2. Computer laboratory
N3. Consultations
N4. Student’s self 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_W03 PEK_U01 PEK_U02 PEK_U03 PEK_K01 PEK_ K03 PEK_K04	oral presentations, reports
F2	PEK_W01 PEK_W02 PEK_W03 PEK_W04 PEK_U01 PEK_U02 PEK_U03 PEK_U04 PEK_K01 PEK_K02 PEK_ K03 PEK_K04	test
P = 0.4*F1+0.6*F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Ph. D. Strafin. Teoria gier, Wydawnictwo Naukowe Scholar 2004.

[2] D. Fudenberg , J. Tirole, Game Theory, MIT Press 1993.

[3] A. Haurie, J.B. Krawczyk, G. Zaccour, Games and Dynamic Games, World Scientific 2012.

SECONDARY LITERATURE:

[1] J. Gonzalez-Diaz, I. Garcia-Jurado, M.G. Fiestras-Janeiro, An Introductory Course on Mathematical Game Theory, AMS Series 2010.

[2] K. Binmore, Playing for Real, Oxford Press 2007.

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

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT

GAME THEORY AND APPLICATIONS MAT1554

AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY

APPLIED 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	Lec 1- Lec 10	1, 3
PEK_W02	K2MIC_W09	C1	Lec 1- Lec 10	1, 3
PEK_U01 (skills)	K2MIC_U15	C1	Lab 1	2, 3, 4
PEK_K01 (competences)	K2MIC_K06	C1	Lec 1- Lec 10, Lab 1 –Lab 2	1, 2, 3, 4

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

*** - from table above