FACULTY OF PURE AND APPLIED MATHEMATICS
SUBJECT CARD

Name in Polish MODELOWANIE AGENTOWE UKŁADÓW ZŁOŻONYCH
Name in English AGENT-BASED MODELLING OF COMPLEX SYSTEMS
Main field of study (if applicable): APPLIED MATHEMATICS
Level and form of studies: ~~1st~~/ 2nd* level, full-time / ~~part-time*~~
Kind of subject: obligatory ~~/ optional / university-wide*~~
Subject code MAT001589
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)	150				
Form of crediting	Examination				
For group of courses mark (X) final course	X				
Number of ECTS points	5				
including number of ECTS points for practical (P) classes	2		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 has the standard knowledge of computational methods in mathematics.
2. Student has basic programming skills.

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SUBJECT OBJECTIVES

C1 Analysis of complex systems by making use of agent-based modelling methods.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:
K2MIC_W08 knows advanced computational methods and understand their limitations

K2MIC_W09 knows basic stochastic modelling methods in financial and actuarial mathematics or in science

relating to skills:
K2MIC_U23 can construct and perform computer simulations and simple experiments, can interpret obtained results and draw conclusions

relating to social competences:

K2MIC_K06 can, without assistance, search for necessary information in the literature, also in foreign languages

K2MIC_K02 can accurately formulate questions for deeper understanding of a given topic

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec 1	Introduction to agent-based modelling	2
Lec 2	Introduction to agent-based modelling	2
Lec 3	Creating simple agent-based models	2
Lec 4	Creating simple agent-based models	2
Lec 5	Exploring and extending agent-based models	2
Lec 6	Exploring and extending agent-based models	2
Lec 7	Exploring and extending agent-based models	2
Lec 8	Exploring and extending agent-based models	2
Lec 9	Components of agent-based models	2
Lec 10	Components of agent-based models	2
Lec 11	Analyzing agent-based simulations	2
Lec 12	Analyzing agent-based simulations	2
Lec 13	Verification and validation of agent-based models	2
Lec 14	Computational roots of agent-based modelling	2
Lec 15	Models of natural and social complex systems - examples	2
	Total hours	**30**

Form of classes - laboratory		Number of hours
La 1	Practical introduction to Python modules for agent-based modelling	2
La 2	Practical introduction to Netlogo	2
La 3	Simple agent-based models (life, ant, heroes and cowards models)	4
La 4	Analysis of existing models (fire, segregation and El Farol models)	8
La 5	SI epidemics model – implementation and analysis	4
La 6	SIR epidemics model – implementation and analysis	2
La 7	Voter and q-voter models – implementation and analysis	8
	Total hours	**30**

TEACHING TOOLS USED

N1. Lecture – traditional method and presentations
N2. Problem and computing laboratory – using computer based methods

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	K2MIC_W08 K2MIC_W09	exam
F2	K2MIC_U23 K2MIC_K02 K2MIC_K06	Oral presentations
C P==0.5*F1+0.5*F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Uri Wilensky, William Rand, "An Introduction to Agent-Based Modeling"

[2] Steven F. Railsback, Volker Grimm, "Agent-Based and Individual-Based Modeling: A Practical Introduction"

SECONDARY LITERATURE:

[1] Robert Siegfried, „Modeling and Simulation of Complex Systems: A Framework for Efficient Agent-Based Modeling and Simulation"

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

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT **AGENT-BASED MODELLING OF COMPLEX SYSTEMS MAT001589** AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **APPLIED MATHEMATICS AND COMPUTATIONAL MATHEMATICS**

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_W08 PEK_W09 (knowledge)	K2MST_W08 K2MST_W09 K2MST_W11 K2MST_cm_W01 K2MST_cm _W02 K2MST_cm _W03	C1	Lec1-Lec15	1,3
PEK_U18 (skills)	K2MST_U17 K2MST_U18 K2MST_U24 K2MST_U25 K2MST_cm _U01 K2MST_cm_U02 K2MST_cm_U03	C1	La1-La7	2,3,4
PEK_K02 PEK_K06 (competences)	K2MST_K02 K2MST_K06 K2MST_cm_K01 K2MST_cm_K02	C1	Lec1-Lec15, La1-La7	1,2,3,4

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

*** - from table above