FACULTY OF COMPUTER SCIENCE AND MANAGEMENT

SUBJECT CARD

Name in Polish Matematyka ekonomiczna
Name in English Mathematical Economics
Main field of study (if applicable): Management
Specialization (if applicable): Organizational Management (OM)
Level and form of studies: 1st level, full-time
Kind of subject: obligatory
Subject code MAZ1146
Group of courses NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	**30**	**15**			
Number of hours of total student workload (CNPS)	**120**	**60**			
Form of crediting	**exam**	**crediting with grade**			
For group of courses mark (X) final course					
Number of ECTS points	**4**	**2**			
including number of ECTS points for practical (P) classes		**2**			
including number of ECTS points for direct teacher-student contact (BK) classes	**1**	**0,5**			

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES
1. Basic knowledge of mathematics and statistics

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SUBJECT OBJECTIVES
C1. Getting to know the mathematical methods and tools used in economics in the following area
        C1.1. The theory of change of money over time
        C1.2. The future lifetime of an individual and models of life insurance
        C1.3. Preferences, utility and random utility
        C1.4. Theory of production and demand
        C1.5. Game theory
C2. The ability of interpretation and quantitative analysis in the following area
        C2.1. The theory of change of money over time
        C2.2. The future lifetime of an individual and models of life insurance
        C2.3. Preferences, utility and random utility
        C2.4. Game theory

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 – has a broad knowledge of mathematics and know its usefulness and usability in economics.

PEK_W02 – knows the value of money changes over time; familiar with mathematical tools that allows to determine the value of money.

PEK_W03 – has knowledge of the factors affecting the shape of the life insurance premiums; knows method of calculating premiums.

PEK_W04 – knows the mathematical theories of economics relating to utility theory, preferences, demand and production.

PEK_W05 – has knowledge of the mathematical theory of conflict (game theory) and knows its place and relevance in the economy.

relating to skills:

PEK_U01 – able to use formal methods and compare offers of financial institutions in the field of investments, loans and mortgages.

PEK_U02 – able to correctly calculate, depending on the assumptions, the value of life insurance premiums.

PEK_U03 – able to apply the theory of preference and utility to build discrete choice models

PEK_U04 – can formulate decision problems such as the allocation of costs, competitive decision making, management-labor arbitration in game theory and find their solution.

relating to social competences:

PEK_K01 – is well-prepared to critically evaluation of the economic problem's solutions and his/her views and arguments can defend using mathematical tools.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec 1	The growth of money I: basic definitions (interest, principal, accumulation and amount function), simple and compound interest, annual and periodic percentage rate, exact and ordinal simple interest, bank's rule, continuous compounding.	2
Lec 2	The growth of money II: invest in advance and effective discount rate, discount function, simple and compound discount, nominal rates of interest and discount, force of interest, inflation.	2
Lec 3	Annuities: annuities-immediate, annuities-due, annuity perpetuities, annuities with payments in geometric and arithmetic progression.	2
Lec 4	Loans: calculating the payment amount, comparing loans.	2
Lec 5	Individual risk models for a short term.	2
Lec 6	Survival distribution and life table: probability for the age-at-death, relation of life table functions to survival function, deterministic survivorship group.	2
Lec 7	Life insurance: insurance payable at the moment of death and at the end of the year of death; continuous life annuities, discrete life annuities, life annuities with monthly payments.	2
Lec 8	Preferences measurement.	2

Lec 9	Mathematical utility theory; random utility models	2
Lec 10	Mathematical theory of demand.	2
Lec 11	Mathematical theory of production.	2
Lec 12	Two-person zero-sum games: matrix games, dominance and saddle points, mixed strategies, application to comparative decision making	2
Lec 13	Two-person non-zero-sum games: Nash equilibria and non-cooperative solutions, the Nash arbitration scheme and cooperative solutions, application to management-labor arbitration and the duopoly problem	2
Lec 14	N-person games: imputations, domination and stable sets, strategic voting	2
Lec 15	Summary	2
	Total hours	**30**

Form of classes - Class		Number of hours
Lab 1	Calculation simple and compound interest as well as rates of discount	3
Lab 2	Determination the loan installments	2
Lab 3	Calculation the value of life insurance premiums	2
Lab 4	Preference and probability of choice	2
Lab 5	Dominance and saddle points in matrix game, solving the matrix games when mixed strategic is used	2
Lab 6	Finding Nash equilibria	2
Lab 7	Written test	2
	Total hours	15

TEACHING TOOLS USED
N1. Presentation N2. Information lecture N3. Own work - preparation for class

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_U01 - PEK_U04	Written test
F2	PEK_W01-PEK_W04	Exam
P = F1 + 2F2		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Kellison S.G. (2008) *The Theory of Interest*, McGraw-Hill/Irwin.

[2] Bowers N.L., Gerber H.U., Hickman J.C., Jones D.A., Nesbitt C.J. (1997), Actuarial Mathematics, Society of Actuaries.

[3] Game theory /ed. by Steven N. Durlauf, Lawrence E. Blume. Basingstoke : Palgrave Macmillan, 2010.

SECONDARY LITERATURE:

[1] Wainwright K., Chiang A. (2004) *Fundamental Methods of Mathematical Economics*. McGraw-Hill/Irwin.

[2] Timothy J. Coelli T.J., Rao D.S. P., O'Donnell Ch.J., Battese G. E. (2005) *An Introduction to Efficiency and Productivity Analysis*, Springer.

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

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Mathematical Economics
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Management
AND SPECIALIZATION **Organizational Management (OM)**

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 PEK_W02	K1_ZARZ_W03 K1_ZARZ_W11 K1_ZARZ_W23	C1.1	Lec1-Lec4, Lec15	N1, N2
PEK_W01 PEK_W03	K1_ZARZ_W03 K1_ZARZ_W23 K1_ZARZ_W25	C1.2	Lec5-Lec7, Lec15	N1, N2
PEK_W01 PEK_W04	K1_ZARZ_W03 K1_ZARZ_W23	C1.3, C1.4	Lec8-Lec11, Lec15	N1, N2
PEK_W01 PEK_W05	K1_ZARZ_W01 K1_ZARZ_W03 K1_ZARZ_W23 K1_ZARZ_W24	C1.5	Lec12-Lec15	N1, N2
PEK_U01	K1_ZARZ_U04 K1_ZARZ_U05 K1_ZARZ_U15 K1_ZARZ_U16	C2.1	Lab 1, Lab 2	N3
PEK_U02	K1_ZARZ_U04 K1_ZARZ_U05 K1_ZARZ_U15 K1_ZARZ_U16	C2.2	Lab 3	N3
PEK_U03	K1_ZARZ_U04 K1_ZARZ_U05 K1_ZARZ_U15 K1_ZARZ_U16	C2.3	Lab 4	N3
PEK_U04	K1_ZARZ_U04 K1_ZARZ_U05 K1_ZARZ_U15 K1_ZARZ_U16	C2.4	Lab 5, Lab 6	N3
PEK_K01	K1_ZARZ_K06	C1.1-C1.5 C2.1-C2.4	Lec1-Lec15 Lab 1 – Lab 6	N1, N2, N3

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