DESCRIPTION OF THE COURSE OF STUDY

Course code	**0719-2ID-F67-E**	
Name of the course in	Polish	*Ekonofizyka*
	English	*Econophysics*

1. **LOCATION OF THE COURSE OF STUDY** within the system of studies

1.1. Field of study	**Data Engineering**
1.2. Mode of study	**Full-time**
1.3. Level of study	**First-cycle engineering studies**
1.4. Profile of study*	**General academic profile**
1.5. Person/s preparing the course description	
1.6. Contact	

2. **GENERAL CHARACTERISTICS OF THE** course of study

2.1. Language of instruction	**Polish**
2.2. Prerequisites*	**The student has basic knowledge of mathematics.**

3. **DETAILED CHARACTERISTICS OF THE COURSE OF STUDY**

3.1. **Form of classes**		**Lecture, tutorial**
3.2. **Place of classes**		**Classes in UJK teaching rooms**
3.3. **Form of assessment**		**Lecture – graded credit; Tutorial – graded credit**
3.4. **Teaching methods**		**Lecture – multimedia presentation, discussion; Tutorial – problem solving, discussion**
3.5. **Bibliography**	**Required reading**	R. N. Mantegna, Introduction to Econophysics, Cambridge University Press P. Glasserman, Monte Carlo Methods in Financial Engineering, Springer, 2004
	Further reading	S. Sinha,Econophysics: An Introduction, Wiley, 2010

4. **OBJECTIVES, SYLLABUS CONTENT AND INTENDED LEARNING OUTCOMES**

4.1 Course objectives ***(including form of classes)***
C1 – Introduction to the basic concepts of econophysics.

4.2 **Detailed syllabus** ***(including form of classes)***

Lectures, tutorials:

1. Basic concepts of economics (the economic theory of human behavior, money, models of economic functioning, public and private sectors, basic elements of the theory of demand and supply, competition, labor market).
2. Functioning of financial markets (financial markets, basic financial instruments such as deposits, shares, bonds, and contracts).
3. Elements of game theory (two-person zero-sum and non-zero-sum games, Nash equilibrium, models, principles, and negotiation strategies).
4. Stochastic processes (elements of mathematical statistics, Central Limit Theorem, Gaussian distribution and Brownian motion in financial data analysis, Lévy distribution – stock prices, geometric Brownian motion, properties of the log-normal distribution, generalization of Brownian motion: diffusion and subdiffusion).
5. Option valuation (options, types of options, methods for determining option prices; discrete models – binomial models [single-period and multi-period]; continuous limit – Black–Scholes model; option pricing using Monte Carlo methods).
6. Market risk (definition, risk measures, VaR – Value at Risk, ES – Expected Shortfall).
7. Portfolio theory (stock portfolio, covariance matrix, Markowitz theory, CAPM model).
8. Linear and chaotic dynamics (price dynamics, debt, supply and demand models, inflation).

4.3 Intended learning outcomes

Code	**A student, who passed the course**	**Relation to learning outcomes**
within the scope of **KNOWLEDGE:**		
W01	understands what the financial market is, its functioning, segments, and organization.	ID1A_W06, ID1A_W09
W02	knows the basic concepts of financial instruments and can describe them; knows the types of derivative instruments and the parameters that determine their values. world.	ID1A_W06, ID1A_W10

within the scope of **ABILITIES:**		
U01	uses basic concepts of econophysics and knows their applications.	ID1A_U06, ID1A_U07
U02	is able to identify types of risk in the financial market and knows the basic techniques of financial data analysis	ID1A_U08, ID1A_U09
U03	knows the fundamentals of stochastic modeling in continuous and discrete option pricing models and applies them in practice; he/she determines option values using the binomial model and the Black–Scholes model	ID1A_U07, ID1A_U08, ID1A_U13
within the scope of **SOCIAL COMPETENCE:**		
K01	understands the need to deepen his/her own knowledge and is able to search for information in textbooks	ID1A_K01, ID1A_K03

4.4. **Methods of assessment of the intended learning outcomes**

Teaching outcomes *(code)*	**Method of assessment (+/-)**																				
	Exam oral/written*			**Test***			**Project***			**Effort in class***			**Self-study***			**Group work***			**Others* e.g. standardized test used in e-learning**		
	Form of classes			***Form of classes***			***Form of classes***			***Form of classes***			***Form of classes***			***Form of classes***			Lecture, tutorial		
	L	*C*	*..*	*L*	*C*	*..*	*L*	*C*	*..*	*L*	*C*	*..*	*L*	*C*	*..*	*L*	*C*	*..*	*L*	*C*	*..*
W01				+	+																
W02				+	+																
U01					+						+			+							
U02					+						+			+							
U03					+						+			+							
K01											+			+							

****delete as appropriate***

4.5. **Criteria of assessment of the intended learning outcomes**

Form of classes	**Grade**	**Criterion of assessment**
lecture (L) (including e-learning)	**3**	**Achievement of <50–60)% of the requirements specified in the assessment methods**
	3,5	**Achievement of <60–70)% of the requirements specified in the assessment methods**
	4	**Achievement of <70–80)% of the requirements specified in the assessment methods**
	4,5	**Achievement of <80–90)% of the requirements specified in the assessment methods**
	5	**Achievement of <90–100)% of the requirements specified in the assessment methods**
classes (C)* (including e-learning)	**3**	**Achievement of <50–60)% of the requirements specified in the assessment methods**
	3,5	**Achievement of <60–70)% of the requirements specified in the assessment methods**
	4	**Achievement of <70–80)% of the requirements specified in the assessment methods**
	4,5	**Achievement of <80–90)% of the requirements specified in the assessment methods**
	5	**Achievement of <90–100)% of the requirements specified in the assessment methods**

5. **BALANCE OF ECTS CREDITS – STUDENT'S WORK INPUT**

Category	**Student's workload**	
	Full-time studies	**Extramural studies**
NUMBER OF HOURS WITH THE DIRECT PARTICIPATION OF THE TEACHER /CONTACT HOURS/	***45***	
*Participation in lectures**	15	
*Participation in classes, seminars, laboratories**	30	
INDEPENDENT WORK OF THE STUDENT/NON-CONTACT HOURS/	***30***	
Preparation for lectures	10	

*Preparation for the classes, seminars, laboratories**	10	
*Preparation for the exam/test**	10	
TOTAL NUMBER OF HOURS	***75***	
ECTS credits for the course of study	**3**	

delete as appropriate

Accepted for execution *(date and legible signatures of the teachers running the course in the given academic year)*

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