STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Mathematical economics**		Code **1010341731010349398**

Field of study **Mathematics in Technology**	Profile of study (general academic, practical) **General academic**	Year /Semester **2 / 3**

Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **elective**

Cycle of study: **First-cycle studies** **(Polish Qualifications Framework level six)**	Form of study (full-time,part-time) **full-time**

No. of hours Lecture: **30** Classes: **-** Laboratory: **-** Project/seminars: **-**	No. of credits **3**

Status of the course in the study program (Basic, major, other) **other**	(university-wide, from another field) **University-wide**

Education areas and fields of science and art **Technical sciences** **Technical sciences**	ECTS distribution (number and %**)** **3 100%** **3 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Student knows the concepts of differential calculus of functions of one variable.
		Student knows the concept of differential calculus of several variables. Vector first derivatives (gradient), the matrix of second derivatives (Hessian). Student knows the relationship the Hessian matrix with concavity.
		Student knows the concept of extreme values of functions of one variable and function of several variables.
		Student knows the basic concepts of matrix algebra:
		-The product of vectors and matrices - Inverse matrix
		-The determinant of a matrix - Negative defined matrix
		-Non-singular matrix - Eigenvalues and eigenvectors
		[K_W01 (P6S_WG), K_W03 (P6S_WG)]
2	**Skills**	Student knows how to calculate derivatives of functions of one variable
		Student knows how to calculate first partial derivatives and second order derivatives of function of several variables. He can determine the gradient, hessian.
		Student can determine the extreme values of functions of one variable
		Student can determine the extreme of functions of several variables
		The student knows how to multiply vectors, matrices, count determinant
		Student can determine the inverse matrix
		Student can determine the values and eigenvectors
		Student is able to think logically
		Students can use the calculator.
		[K_U01 (P6S_UW), K_U03 (P6S_UW)]
3	**Social competencies**	Student knows the limitations of their knowledge and understands the need for further education
		[K_K01 (P6S_KK)]

Assumptions and objectives of the course:

The aim of the course is to acquaint students with selected problems of mathematical economics: the theory of consumer demand, the theory of supply the manufacturer, the market equilibrium theory, the theory of productive economy and use of learned theories to solve problems using mathematical tools.

Study outcomes and reference to the educational results for a field of study
Knowledge:
1. The student has a basic knowledge: of demand theory; of the theory of supply; of the theory of market equilibrium. The student knows the basic problem of the consumer. The student knows the basic problem of the manufacturer. The student knows the laws: demand, production, market equilibrium. The student has a basic knowledge necessary to understand the economic conditions of the various activities e.g. in the engineering. - [K_W12 (P6S_WK)]
2. The student knows and understands the basic economic conditions . - [K_W14 (P6S_WK)]
Skills:
1. Student is able to maximize the utility of the consumer. Student is able to determine the function of consumer demand for a fixed income. Student is able to maximize income (minimize cost) of producer. Student is able to determine the structure of equilibrium prices. - [K_U08 (P6S_UW)]
2. Student is able to determine (for the matrix inputs of productive economy) the optimal vector of production, vector of optimal price and determine the percentage growth of the economy. Student in formulating tasks for various activities e.g. in engineering, is able to see the economic aspects. - [K_U08 (P6S_UW)]
Social competencies:
1. The student is aware of the level of his knowledge in relation to the conducted research - [K_K01 (P6S_KK)]
2. Student is able to think and work in a creative way. Student understands the need to work systematically on all tasks. - [K_K03 (P6S_KO)]
3. The student understands the importance of intellectual honesty in the actions of their own and other people - [K_K04 (P6S_KR)]
4. The student is aware of his social role as a graduate of technical university - [K_K05 (P6S_KR)]

Assessment methods of study outcomes
Lecture
Valuation of knowledge and skills during written exam.
Course description

1.The theory of preferences

Space of goods. A metric space. Relations and their properties.

Preference relation and strong preferences. Contours.

Continuity of preferences. Bounded set, convex set.

Properties of functions in a convex set. Preferred basket of goods.

2.The theory of demand

The utility function and its properties. Deficiency.

Marginal utility. Marginal rate of substitution.

Budget constraint. The function of demand.

The demand Hicks function. The function of cost of the consumer.

Demand equation. Slutsky equation.

Compensating for price changes. The conclusions of the demand equation. Elasticities.

3.The theory of supply

Scalar function of production. Marginal efficiency.

Substitution and elasticities (scale of production).

Costs and income. The production demand function. The supply function.

Equation of production and conclusions.

Cost function. The short-run costs.

The average cost. The marginal cost.

4.The theory of equilibrium

The exchange of goods. Market exchange.

The excessive demand function. Equilibrium price.

5.The economic growth

Leontief model of the economy. Matrix of expenditures.

Leontief space of economy.

The productivity of the economy. Cleaner production.

The efficiency of the process and production.

Technological and economic efficiency.

Von Neumann equilibrium.

Applied methods of education:

- lectures:

 lecture with multimedia presentation supplemented by examples given on the blackboard

 Interactive lecture with questions to students

 Presenting a new topic preceded by a reminder of related content known to students from other subjects

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Basic bibliography:

1. Emil Panek: Ekonomia matematyczna, AE Poznań 2000.

2. Emil Panek: Podstawy Ekonomii Matematycznej. Materiały do ćwiczeń, MD nr 125, AE Poznań 2002.

3. Stanisława Kanas: Podstawy ekonomii matematycznej ,Wydawnictwo Naukowe PWN, 2011.

Additional bibliography:

1. Grzybowska Urszula: Ekonomia Matematyczna. Teoria. Przykłady. Zadania. SGGW

2. M. Konopczynski, R. Kiedrowski: Podstawy Ekonomii Matematycznej. Elementy teorii popytu i równowagi rynkowej, MD nr 165, red. Emil Panek, AE Poznan, 2005.

3. Alpha C. Chiang: Podstawy ekonomii matematycznej, PWE 1994

4. Joanna Górka , Witold Orzeszko , Marcin Wata: Ekonomia Matematyczna. Materiały do ćwiczeń, C.H. Beck 2009

Result of average student's workload

Activity	Time (working hours)
1. participation in lectures (15 x 2h.)	30
2. participation in the consultations related to the realization of the education process (4 x 2h.)	8
3. familiarization with the indicated literature / teaching materials (17h.)	17
4. preparing to pass the course and participation in completion of lectures (18h. + 2h.)	20

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	75	3
Contact hours	40	2
Practical activities	0	0