STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Transport Optimization		**1010611261010610629**

Field of study	Profile of study (general academic, practical)	Year /Semester
Transport	**(brak)**	**3 / 6**

Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Logistics of Transport	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **2** Classes: **-** Laboratory: **1** Project/seminars: **-**	**3**

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

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

Responsible for subject / lecturer:

Piotr Sawicki, Ph.D.
email: piotr.sawicki@put.poznan.pl
tel. 61 665 22 49
Faculty of Machines and Transport
3 Piotrowo street, 60-965 Poznan, Poland

Responsible for subject / lecturer:

Hanna Sawicka, Ph.D.
email: piotr.sawicki@put.poznan.pl
tel. 61 665 22 49
Faculty of Machines and Transport
3 Piotrowo street, 60-965 Poznan, Poland

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Student has a basic knowledge related to Operational Research
2	**Skills**	Student is able to think analytically, to interpret the phenomena, and to build simple mathematical models based on the verbal problem description
3	**Social competencies**	Student is aware of the role and importance of making the right decisions and problems concerning transport activities

Assumptions and objectives of the course:

-The objective of the course is as follows: knowledge of managerial decision-making techniques, including: the allocation of existing potential, the allocation of workers to activities, desining the transport plan, design of a transport system, traffic control in the transport network

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Has knowledge of mathematics including: elementary functions, series of numbers, continuity and limes of functions, calculus of one and several variables, determinants, matrices, algebraic systems of linear equations, calculus of several variables, integrals on lines and surfaces, complex numbers - [K1A_W01]

2. Has a structured, theoretically founded knowledge in the field of traffic engineering, knows analytical models of traffic flows, road transport efficiency, optimization of transport network. - [K1A_W05]

3. Has a structured, theoretically founded knowledge in the field of operations research, including: linear programming, discrete issues. - [K1A_W08]

4. Has a structured, theoretically founded knowledge in the field of logistics, including: the essence of logistics, the reasons for the development of logistics concepts, structure of logistic systems, logistics management, exploitation of synergies, decision-making problems in micrologistic systems, the importance of logistics in the supply. - [K1A_W09]

Skills:

1. Is able to develop a safety manual for the designed system and transport/logistics process. - [K1A_U11]

2. Is able to organize and manage the transport, logistics and freight forwarding process in field of study, especially in the chosen specialization. - [K1A_U16]

3. Is able to use acquired mathematical theories to create and analyze simple models of transport and logistics systems. - [K1A_U18]

4. Is able to create a system schematics, select items and perform basic calculations of the magazine layout - [K1A_U19]

Social competencies:

1. Understands the need and knows the possibilities of lifelong learning, knows the need for acquiring new knowledge for professional development. - [K1A_K01]
2. Is aware of and understands the importance and impact of non-technical aspects of mechanical engineering activities and its impact on the environment and responsibility for own decisions in short and long-term aspect. - [K1A_K02]
3. Is able to think and act in an entrepreneurial manner, make decisions, work for the development of the employer and the society. - [K1A_K07]
4. Is aware of the transfer of knowledge to society, takes steps to ensure that the information is understandable - [K1A_K08]

Assessment methods of study outcomes

-The intermediate evaluation is proving to have an overwiev on: design of mathematical model for the defined problem, solving the problem using the Solver, building and solving the problem using linear programming formulation, transportation problem and assignment problem.

- The final assessment is executed based on the ability of independent construction of the mathematical model and optimization of the the analyzed problem in transportation sector.

- The final multiple-choice test is curried out.

Course description

-Basic concepts and elements of the mathematical model. Keywords: the transport system, management in transportation systems, decision-making, the decision-maker, the optimal solution and feasible solutions (decisions).

Components of the mathematical model: the objective function and constraints, and decision variables, parameters, construction of a mathematical model for a simple problem.

Efficient resource utilisation. The concept of linear programming (LP) and integer programming (IP); characteristics of the mathematical model, the solution domain, the area of application of LP and IP.

The structure of optimization model for the following decision problems: the product portfolio for the transportation company, optimisation of car dealers portfolio, fleet composition for the public transportation (vehicles assignment for the communication lines).

Application of MS Solver to solving decision problem, the interpretation of the result and sensitivity analysis.

Freight transportation planning and design of the simple distribution networks of the goods. The concept of transportation problem: the construction of a mathematical model of classical transportation problem; redesign the classical model (sender-receiver) by additional player (sender-retailer-receiver). Determination of the size and location of the warehouse using MS Solver in solving transportation problem; interpretation of the results.

The allocation of workers to tasks. The concept of the assignment problem, construction of a mathematical model, the methods of obtaining information about a potential allocation of staff, the meaning of the learning curve and its practical interpretation. A use of MS Solver to solving assignment problems.

Basic bibliography:

1. Sawicki P. Management of transportation systems. E-papers available on: www.put.poznan.pl/~piotr.sawicki (in Polish).
2. Leszczyński J.: Modelling of transportation systems. Wydawnictwo Politechniki Warszawskiej, Warsaw, 1995 (in Polish).
3. Lotfi V., Pegels C., Decision Support Systems for Management Science / Operations Research. Irvin, Homewood, 1989.
4. Cooke W. P.: Quantitative methods for Management Decisions. McGraw ? Hill Book Company, New York, 1995.

Additional bibliography:

1. Ignasiak E. (ed.) Operational Research. Wydawnictwo PWE, Warsaw, 2000 (in Polish)
2. Szapiro T. (ed.). Managerial decisions with Excel. Wydawnictwo PWE, Warsaw, 2000 (in Polish).
3. Krawczyk S. Quantitative methods in logistics (in comapnies). Academia Oeconomica, C.H.Beck. Warsaw, 2001 (in Polish).
4. Jęrzejczyk Z. et al., (ed.) Operational research - Case studies. Wydawnictwo Naukowe PWN, Warsaw, 2007 (in Polish)

Result of average student's workload

Activity	Time (working hours)
1. Lectures	30
2. Labs	15
3. Own work	15

Student's workload

Source of workload	hours	ECTS
Total workload	60	3
Contact hours	45	2
Practical activities	15	1