THE INTERNATIONAL UNIVERSITY OF LOGISTICS AND TRANSPORT IN WROCLAW

SYLLABUS

Teacher					
Course	Mathematical Modelling in Warehouse Management				
Module	Optional course	ECTS	4	Course code	23SM.P.L.B.IEP.1.2

Field of study	Major	Academic year
LOGISTICS	Industrial systems engineering	2023/2024
Semester	SECOND	Year of studies	FIRST

Type of studies	Full-time				Extramural			
Type of classes	Lecture	Exercise	Laboratories	Project	Lecture	Exercise	Laboratories	Project
Amount of hours	30		30					
TOTAL	60							

Course objectives	The course answers all questions about the basic concepts of inventory management in a modern warehouse, from a financial, physical, forecasting and operational point of view. The course provides a timeless basis for storing inventory to optimize performance and increase profits.

Minimum knowledge required from the student before the classes beginning
Ability to use MS Excel spreadsheet in econometric and statistical applications. Basic knowledge in systems engineering regarding process modelling.

Recommended literature to study before the classes beginning

LEARNING OUTCOMES			KEK	METHODS OF ASSESSMENT	
KNOWLEDGE	K01	Proficiently identify, describe and analyse economic and organizational conditions of logistics activities in a modern warehouse, in particular in the field of inventory management	K2_W01_L_P	EM4 EM9	Written exam with open questions. Written colloquium with computational tasks
	K02	Demonstrate proficiency in strategic warehouse management, including the principles of analysis, diagnosis and decision making in the field of inventory management. Explain and apply analytical methods for mathematical analysis of inventory management models.	K2_W02_L_P	EM4 EM9	Written exam with open questions. Written colloquium with computational tasks
	K03	Explain and apply the basics of operational research methodology and mathematical modelling in supporting decisions regarding optimization of inventory management in a warehouse using IT systems of the WMS class	K2_W12_L_P	EM4 EM9	Written exam with open questions. Written colloquium with computational tasks
SKILLS	S01	Use integrated knowledge from various fields and choose the appropriate mathematical methods and tools to identify, interpret, describe and analyse the problems of inventory management in the warehouse and their conditions	K2_U01_L_P	EM11 EM15	Reports evaluation Evaluation of activity in the lab.
	S02	Use the skill of applying linear modelling to create simple decision models and to predict the course of selected logistics processes in a warehouse using quantitative methods and WMS IT systems	K2_U04_L_P	EM11 EM15	Reports evaluation Evaluation of activity in the lab.
	S03	Utilize the ability to choose the right IT tools (WMS) necessary to control warehouse processes and logistics systems, as well as to assess their effectiveness, efficiency and usefulness	K2_U05_L_P	EM11 EM15	Reports evaluation Evaluation of activity in the lab.
	S04	Use knowledge of mathematical linear modelling to identify problems and acquire data to describe, analyse and evaluate logistic warehouse processes	K2_U09_L_P	EM11 EM15	Reports evaluation Evaluation of activity in the lab.
SOCIAL	SC01	Demonstrate proficiency in formulating linear mathematical modelling for modern warehouse management, including using WMS	K2_K01_L_P	EM4	Written exam with open questions

SOCIAL COMPETENCE	SC03	Demonstrate the ability to independently and critically acquire knowledge and skills, as well as complement and develop them using modern process modelling and the use of WMS class IT systems	K2_K04_L_P	EM16	Assessment of the work, students co-operation in the classroom

Course contents	Lecture	1. Forecasting inventory levels and making decisions about replenishment, the right goods, in the right quantities, at the right time, and at the right place. 2. Use of simple formulas to calculate break-even points, profit margins, margins and reductions, as well as sales prices and margin percentages. 3. Using financial indicators to improve the functioning of the warehouse in a logistics company. 4. Resource management as a physical object and a database object. 5. Setting up an effective inventory location system. 6. Implementing effective placement theories. 7. Analysis of differences between stocks of finished (retail) products and stocks of raw materials or production in progress (production). 8. Deciding when to dispose of a dead stock. 9. Choose the right cycle counting method for your organization and use it to avoid problems over long distances. 10. IT material requirements planning (MRP) and just-in-time (JIT) storage systems. 11. Security systems against supply chain threats.
	Laboratories	1. Solving problems in the field of linear modelling in inventory management using the MS EXCEL sheet. Part 1 - building a model for a given algorithm 2. Solving problems in the field of linear modelling in inventory management using the MS EXCEL sheet. Part 2 - initial situation design (graphically) 3. Solving problems in the field of linear modelling in inventory management using the MS EXCEL sheet. Part 3 - designing and entering data into the model and analysing solutions - a discussion about optimality 4. Designing a task in the field of inventory management using the didactic version of SAP WMS. Part 1 - system structure, modules, system interface 5. Designing a task in the field of inventory management using the didactic version of SAP WMS. Part 2 - entering data into the system for the task received from the lecturer. Work in teams of three 6. Exploitation of the SAP WMS system for various decision-making tasks on the basis of tasks provided by the lecturer. Work in teams. 7. Classes in the real warehouse of a logistics company (eg AMAZON) and solving tasks using SAP WMS

Teaching methods	TM2	A lecture with a multimedia presentation, topic-related films, discussions
	TM15	Using IT systems to design models of production processes and analyse the results obtained during the simulation

Obligatory literature	1	Hillier F.S., Lieberman G.J., Introduction to Operations Research, McGraw-Hill Education, 2021
	2	Winston W.L., Operations Research: Applications and Algorithms, Cengage Learning, 2019
	3	Albright S.C., Winston W.L., Business Analytics: Data Analysis and Decision Making, Cengage Learning, 2020

Additional literature	1	Bazaraa M.S., Jarvis J.J., Sherali H.D., Linear Programming and Network Flows, Wiley, 2018
	2	
	3	

Requirements to pass the course
Proficiently identify, describe and analyse economic and organizational determinants of logistics activities, in particular in the field of controlling and assessing logistics processes The condition of passing the course is to obtain a positive grade from a written exam containing three tasks in the field of using linear programming to manage inventory in a warehouse. The condition of admission to the exam is: • attendance at all laboratory classes, any absence requires the solution of additional tasks; • passing a written test • passing at least two project tasks, including one using SAP WMS The final grade is the average grade using weights: 50% exam grade, 20% colloquium grade, 20% current laboratory grade grades 10% lecture attendance. Note: absence from classes in a logistics company does not require to solve the additional tasks