



GRADUATE STUDY: ITS AND LOGISTICS

SEMESTER (I)

Syllabus

Academic year 2023/2024

Course:		Warehouse Transport and Storage			
Head of course: Prof. Kristijan Rogić , Ph.D.					
Co-lecturers: Asst. Prof. Ivona Bajor , Ph.D.					
Semester: I	Course code: 186780	Lectures: 30	Auditory exercises: 20	Laboratory exercises: 10	ECTS credits: 6
Group for lectures: 40 - 50 students			Group for auditory and laboratory exercises: 5 - 10 students		

Objective of the course:

- Course provides knowledge of warehouse transport and storage from the aspect of supply chain. It consist of these topics: Basics of performance measurement, Division of warehouses (I, II), Warehouse site selection factors, Definition of basic storage operations, Unit loads, Warehouse operations, Commissioning and the organization of collection of goods, Picking systems, Storage equipment, Forklifts, Organization of goods flow and storage, Automated guided vehicles, Virtual storage, Optimizing warehouse operations.

Learning outcomes:

After the completion of the course the students will be able to:

1. Explain the storage system elements
2. Identify the processes within the warehouse
3. Calculate the optimal location of the storage facility
4. Evaluate the efficiency parameters of individual storage processes
5. Explain the advantages and disadvantages of existing warehouse systems
6. Create inventory solutions
7. Apply methods for optimizing individual processes (reception, storage, manipulation, commissioning)
8. Design a specific warehouse process





LECTURES and EXERCISES

Week	Syllabus	Form of classes	Performed by	Lessons	Remark
1.	<ul style="list-style-type: none"> Introduction to the course content, Keynote lecture, case studies, the basic terminology, literature 	L	Kristijan Rogić	2	
	<ul style="list-style-type: none"> Basics of Performance Measurement Review of methods for evaluating warehouses 	AE	Kristijan Rogić	2	
2.	<ul style="list-style-type: none"> Division of warehouses (by possesor, location and construction) 	L	Kristijan Rogić	2	
	<ul style="list-style-type: none"> Calculation of the theoretical traffic storage capacity (tasks) 	AE	Kristijan Rogić	2	
3.	<ul style="list-style-type: none"> Division of warehouses (by type of goods and storage technology) 	L	Kristijan Rogić	2	
	<ul style="list-style-type: none"> Calculation of the actual storage capacity (tasks) 	AE	Kristijan Rogić	2	
4.	<ul style="list-style-type: none"> Warehouse site selection factors, narrower and broader location 	L	Kristijan Rogić	2	
	<ul style="list-style-type: none"> Calculation of a suitable site to build a warehouse (tasks) Methods of calculating the location of the warehouse 	AE	Kristijan Rogić	2	
5.	<ul style="list-style-type: none"> Definitions of basic storage operations Unit loads 	L	Kristijan Rogić	2	



	<ul style="list-style-type: none"> • Calculation of useful storage areas (tasks) 	AE	Kristijan Rogić	2	TEST 1
6.	<ul style="list-style-type: none"> ▪ Warehouse Operations ▪ Receiving and storage of goods 	L	Ivona Bajor	2	
	<ul style="list-style-type: none"> ▪ Calculation of storage utilization coefficient (tasks) 	AE	Ivona Bajor	2	
7.	<ul style="list-style-type: none"> ▪ Commissioning and the organization of collection of goods, the concept of picking, the criteria for the optimization and implementation of commissioning 	L	Ivona Bajor	2	
	<ul style="list-style-type: none"> ▪ Simulation of goods flow in warehouses 	AE	Ivona Bajor	2	
8.	<ul style="list-style-type: none"> ▪ Picking systems, documentation, item location, addressing systems, the level of training of staff 	L	Ivona Bajor	2	
	<ul style="list-style-type: none"> ▪ Simulation of goods flow in warehouses 	AE	Ivona Bajor	2	
9.	<ul style="list-style-type: none"> ▪ Storage equipment, equipment for the reception and storage of goods in warehouses 	L	Ivona Bajor	2	
	<ul style="list-style-type: none"> ▪ Calculation of required number of pallets (tasks) 	AE	Ivona Bajor	2	
10.	<ul style="list-style-type: none"> ▪ Forklifts, the division by the machinery, operation, construction, purpose. Specifications and truck components, use the type of goods, the required space for manipulation 	L	Ivona Bajor	2	



	<ul style="list-style-type: none"> Calculation of required number of forklifts (tasks) 	AE	Ivona Bajor	2	
11.	<ul style="list-style-type: none"> Organization of storage of goods and flows of goods within the warehouse, warehouse design, defining the layout and location of the passage 	L	Ivona Bajor	2	
	<ul style="list-style-type: none"> Practical example of the organization of internal storage and transport depots 	AE	Ivona Bajor	2	
12.	<ul style="list-style-type: none"> Automatically guided vehicles, structural solutions, a division of automatically guided vehicles 	L	Ivona Bajor	2	
	<ul style="list-style-type: none"> Simulations automatically guided vehicles for internal transport in the warehouse 	AE	Ivona Bajor	2	
13.	<ul style="list-style-type: none"> The organization of virtual storage, information flow, transport processes, monitoring information systems, planning 	L	Ivona Bajor	2	
	<ul style="list-style-type: none"> Laboratory exercises 	LE	Ivona Bajor	2	
14.	<ul style="list-style-type: none"> Methods for optimizing warehouse operations, shortest path 	L	Ivona Bajor	2	
	<ul style="list-style-type: none"> Laboratory exercises 	LE	Ivona Bajor	2	
15.	<ul style="list-style-type: none"> The warehouse management systems, methods of monitoring flows of goods in the warehouse, the RFID technology storage, document management and data 	L	Ivona Bajor	2	
	<ul style="list-style-type: none"> Laboratory exercises case study 	LE	Ivona Bajor	1	TEST 2

L = Lectures; AE = Auditory Exercises; LE = Laboratory Exercises; S = Seminars





STUDENT OBLIGATIONS AND EXAMS

Conditions for obtaining signatures:

During the semester students have the option of taking two tests. Each test consists of numerical and theoretical questions (or their combination) in which it is possible to achieve a maximum of 80 points. Students that achieve a total of 20 points or more have an option of taking the second test. Students that achieve a total of 20 points or more on the second test are exempted from a written exam. Students that do not achieve minimum of 20 points have to take a written exam.

The written and oral exam is provided for all students, regardless. To pass the written exam it is necessary to answer 51% of questions correctly, and the grading system is shown in "scoring system". Verbal evaluation of the cognitive skills of applying empirical facts and theoretical knowledge is organized after finishing written exam and getting positive evaluation.

Students are required to attend lectures and exercises. Students that at the end of semester have minimum of 70% of attendance get 10 points (5 points for lectures and 5 points for exercises attendance). Students that do not achieve those points have to take course once again. In the case of justified absences (for more than 3 times during lectures and more than 3 times for exercises), students have to submit medical records or other official records (which are subject of verification). After successful verification process and seminar paper acceptance students get 20 points.

LITERATURE

a) Obligatory literature:

1. Richards G.: Warehouse Management: A Complete Guide to Improving Efficiency and Minimizing Costs in the Modern Warehouse, Kogan Page Limited, UK, 2011. ISBN-13: 978-0749460747

b) Recommended literature:

1. Warehouse Management: Automation and Organisation of Warehouse and Order Picking Systems, Springer Verlagis, Germany; 2006. ISBN-13: 978-3540352181
2. Thierry, C.; Thomas, A.; Bel, G.: Simulation for Supply Chain Management, ISTE Ltd. London, UK, 2008.





1. LECTURES

Lectures follow specific topics from compulsory literature and are performed using Power Point presentation (in English). The use of a textbook and recommended literature allows students to prepare the lecture topics in advance. Lectures are published on student's portal on the Faculty internet site (e-student). The students are encouraged to read the topic of the forthcoming lecture in advance and to take part in the pro-active discussion.

2. AUDITORIAL EXERCISES

Students solve problems using applied methods. During exercises students learn to conduct research regarding reverse logistics processes and evaluating them. Students are calculating the benefits and channels of reverse logistics to direct used product and transport packaging.

3. LABORATORY EXERCISES

Laboratory exercises are performed in a way to include students into research and/or project drafts and measurements in real and/or laboratory conditions, as respondents and/or students' researchers, using devices of the Laboratory for simulations in logistics or other laboratories of FPZ.

Note: Individual and/or group viewing negative written test

Individual at the time of consultation or a designated period after each colloquium and / or written exam. If necessary and at the request of a group of students in the form post exam exercises in order to explain the most common mistakes typical, after discussion with the team responses to individual student issues.





4. DOCUMENTATION

The student's attendance record is kept during the semester. Achievements of goals are recorded by continuous monitoring on information system ISVU. All tests are kept in lecturer's file for one year.

5. SCORING SYSTEM

Each test consists of numerical and theoretical questions (or their combination) in which it is possible to achieve a maximum of 80 points. Students that achieve a total of 20 points or more have an option of taking the second test. Students that achieve a total of 20 points or more on the second test are exempted from a written exam. Students that do not achieve minimum of 20 points have to take a written exam.

The written and oral exam is provided for all students, regardless. To pass the written exam it is necessary to answer 51% of questions correctly, and the grading system is shown in paragraph 4 (Course gradation).

Students are required to attend lectures and exercises. Students that at the end of semester have minimum of 80% of attendance get 20 points (10 points for lectures and 10 points for exercises attendance). Students that do not achieve those points have to take course once again. In the case of justified absences (for more than 3 times during lectures and more than 3 times for exercises), students have to submit medical records or other official records (which are subject of verification). After successful verification process students get 20 points.

Table 1 - The scoring system for the monitoring of students and explained credit values in ECTS credits

no	Segment:	Required credits to be achieved:		Remark:	ECTS credits
		Min.	Max.		
1.	I test	20	40	50% minimum	2
2.	II test	20	40	50% minimum	2
3.	Seminar paper	10	10	Accepted paper	1
4.	Presence	10	10	Presence \geq 70%	1
Σ	Overall points:	Σ 60	Σ 100	Overall ETCS points:	Σ 6





Table 2 - Explanation of the credit values in evaluations

CREDITS:	Estimate based on attendance, seminar paper and two colloquies (or written exam) - [4 ECTS]:	The final score [5 ECTS]:
60 - 70	Sufficient (2)	Exemption from the written part of the exam, the final score after oral exam
71 - 80	Good (3)	
81 - 90	Very good (4)	
91 - 100	Excellent (5)	

Information for students (scoring system, implementation plan, learning outcomes, syllabus, literature, consulting teachers, announcement of results of examinations or colloquium, and all other information):

- <https://moodle.srce.hr/2022-2023/>
- <http://www.fpz.unizg.hr>

Student assistants:

Additional individual work with the students through individual consultations for assignments from auditory exercises and / or research designs from laboratory exercises.

