## STUDY MODULE DESCRIPTION FORM

| Name of the module/subject **Simulation in Logistics I** | Code **1010612311010617930** |
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| Field of study **Transport** | Profile of study (general academic, practical) **general academic** | Year /Semester **1 / 1** |
|---|---|---|

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

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

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

| 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** | ECTS distribution (number and %**)** **3   100%** |
|---|---|

### Responsible for subject / lecturer:

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### Prerequisites in terms of knowledge, skills and social competencies:

| 1 | **Knowledge** | Student has a basic knowledge related to inventory management, definition of distribution network design and inbound vs. outbound transportation. |
|---|---|---|
| 2 | **Skills** | Student is able to think analytically and to interpret the phenomena. |
| 3 | **Social competencies** | Student is aware of the role and importance of making the right decisions and problems concerning logistics activities. |

### Assumptions and objectives of the course:

Presentation of the main factors determining the proper design of internal logistics (in storage facilities) and external (in the distribution network of goods). The subject matter of the course also includes the acquisition of practical skills in phenomena and logistic solutions? simulation modeling.

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

### Knowledge:

1. The student has an advanced detailed knowledge of selected issues in the field of transport engineering. - [T2A_W03]

2. The student knows advanced methods, techniques and tools used in solving complex engineering tasks and conducting research in a selected area of transport. - [T2A_W06]

### Skills:

1. The student is able to plan and carry out experiments, including measurements and simulations, interpret the obtained results, draw conclusions, formulate and verify hypotheses related to complex engineering problems and simple research problems. - [T2A_U03]

2. The student is able to use analytical, simulation and experimental methods to formulate and solve engineering problems and simple research problems. - [T2A_U04]

### Social competencies:

1. The student understands the importance of using the latest knowledge in the field of transport engineering in solving research and practical problems. - [T2A_K02]

### Assessment methods of study outcomes

The test, which includs the following aspects of simulation in logistics: knowledge of the logistics system design methodology, simulation modeling skills in the ExtendSim tool, skills to build a simulation model of logistic system and verification of the project.

| Course description |
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1. Introduction to the course, the definition of the following concepts: logistic design, micro and macro design, criteria for the division of logistic objects, classification of logistic objects, dimensioning of the logistics supply chain, types of transport and logistics networks, main functions implemented in logistic facilities, processes of goods? flow through logistic objects.

2. Methodology of simulation design - design principles, main stages, practical tips.

3. Presentation of ExtendSim simulation tool: work area, libraries, objects, types of flows, parameters of objects, principles of model construction, presentation of an example application of a tool - case of packing finished products. Construction of a simulation model, parameterization of the model, conducting experiments, analysis of the result.

4. Construction of a warehouse model, selection of objects for modeling key flows of goods (human resources, handling devices / means of transport, pallet space, etc.); case study - order picking model, case study - stock replenishment model. Construction of a simulation model, parameterization of the model, conducting experiments, interpretation of the solution.

5. Construction of a conceptual model of the transport system, selection of elements and their parameterization (means of transport, routes, speeds, etc.). Analysis of the case of determining the number of transportation means in a fuel distribution company. Construction of a simulation model, parameterization of the model, conducting experiments, interpretation of the solution.

6. Construction of a conceptual model of the supply chain, selection of objects for simulation modeling; case study manufacturer-distributor-retailer. Construction of hierarchical models, construction of a supply chain simulation model, parameterization of objects, conducting experiments, interpretation of the solution. Evaluation of the solution, proposal of the supply chain redesign, evaluation of changes.

7. Contemporary trends in the field of simulation modeling, including optimization in simulation.

**Basic bibliography:**

1. Coyle J.J., Bardi E.J., Langley C.J. Jr.: The management of business logistics. West Publishing Company, St. Paul, 1996.

2. ExtendSim User Guide, ver. 9, Handbook, Imagine That Inc., San Jose (CA), 2017.

3. Law A.M., Kelton W.D., Simulation modeling and analysis. McGraw-Hill. Boston, 2000.

4. Sawicka H.: Symulacje w logistyce. Materiały wykładowe, Politechnika Poznańska. (in Polish)

**Additional bibliography:**

1. Gubała M., Popielas J.: Podstawy zarządzania magazynem w przykładach. Instytut Logistyki i Magazynowania, Poznań, 2005 (in Polish).

2. Pfohl H-Ch.: Zarządzanie logistyką. Funkcje i instrumenty. Instytut Logistyki i Magazynowania, Poznań, 1998 (in Polish).

3. Tarkowski J. i in.: Transport ? Logistyka. Instytut Logistyki i Magazynowania, Poznań, 2001 (in Polish).

## Result of average student's workload

| Activity | Time (working hours) |
|---|---|
| 1. Preparation for classes: lectures. | 3 |
| 2. Preparation for classes: labs. | 5 |
| 3. Participation in the classes according to the plan: lectures | 30 |
| 4. Participation in the classes according to the plan: labs. | 15 |
| 5. Strengthening the content of classes / reports: lectures. | 5 |
| 6. Strengthening the content of classes / reports: labs. | 5 |
| 7. Consultations: lectures. | 2 |
| 8. Consultations: labs. | 3 |
| 9. Preparation for the exam / pass: lectures. | 5 |
| 10. Preparation for the exam / pass: labs. | 0 |
| 11. Participation in the exam / pass: lectures. | 2 |
| 12. Participation in the exam / pass: labs. | 0 |

## Student's workload

| Source of workload | hours | ECTS |
|---|---|---|
| Total workload | 75 | 3 |
| Contact hours | 45 | 2 |
| Practical activities | 15 | 1 |