COURSE DESCRIPTION CARD - SYLLABUS

Course name
Process simulations in air transport [S1Lot2-ORL>SPwTL]

Course

Field of study
Aviation

Year/Semester
2/4

Area of study (specialization)
Air Traffic Organisation

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Knowledge: the student has a structured, theoretically founded knowledge of transport systems and various means of transport; basic knowledge of logistics; basic knowledge of the operation of terminals and knows English at a basic level. Skills: the student is able to think analytically and interpret the described phenomena. Social competences: the student understands that in technology, knowledge and skills very quickly become obsolete; can work independently as well as in a team.

Course objective

Designing simulation models and experiments of selected processes in air transport, including: acquiring practical skills in simulating logistic phenomena and solving decision-making problems occurring in air transport.

Course-related learning outcomes

Knowledge:
1. Student has ordered and theoretically founded general knowledge in the field of key technical issues and detailed knowledge of selected issues related to air transport, knows the basic techniques, methods and tools used in the process of solving tasks related to air transport, mainly of an engineering nature.

2. Student has detailed knowledge related to selected issues in the field of manned and unmanned aircraft construction, in the field of on-board equipment, control systems, communication and recording systems, automation of individual systems, has basic knowledge of flight simulation training devices and simulation methods used to solve air transport issues.

Skills:
1. Student is able to properly use information and communication techniques, applicable at various stages of the implementation of aviation projects
2. Student is able to properly plan and perform experiments, including measurements and computer simulations, interpret the obtained results, and correctly draw conclusions from them.

Social competences:
1. Student is aware of the importance of knowledge in solving engineering problems and knows examples and understands the causes of faulty engineering projects that have led to serious financial and social losses, or to a serious loss of health and even life.
2. Student correctly identifies and resolves dilemmas related to the profession of an aerospace engineer.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

In the lecture part: written test summarizing lectures in the subject, in the form of a multiple-choice test.
In the laboratory part: activity during classes and ongoing preparation for classes. Implementation of laboratory tasks individually and in groups.

Programme content

Lecture and laboratory classes are closely related. On the basis of the content presented during the lectures, the tasks (in most cases problematic, based on case studies) are performed during the laboratory classes.
1. Introduction to simulation methods, including classification of simulation methods and models; main components of the simulation model.
2. Methodology of solving decision problems with the use of simulation. Introduction to the ExtendSim simulation tool as an example of a stochastic, discrete and object-oriented simulation tool.
3. Application of computer simulation in transport processes in aviation.
4. Designing the passenger service system at the airport.
5. Planning the handling capacity of the passenger terminal.
6. Modeling of air service at border crossings.
7. Solving the fleet composition problem in air transport.

Course topics

1. Introduction to Simulation. Basic simulation of transport Process.
The essence of simulating transport processes in air transport. Classification of simulation models. The simulation tool ExtendSim in the educational process (availability, usage). Case Study 1 - Impact of flight schedules on aircraft departure delays.
2. Simulation methodology. Simulation of passenger luggage handling process.
Methodology for building a simulation model and using simulation in the decision-making process. Basic objects and functions of ExtendSim (object catalog). Case Study 2 - Modeling the impact of the number of
active check-in counters on the handling time of checked luggage.
3. Modeling the capacity of selected areas of a passenger terminal.
The essence of designing the capacity of a passenger terminal. New objects and functions of ExtendSim. Case Study 3 - Planning the handling capacity to manage passenger traffic in the passenger terminal (ARR/DEP).
4. Planning passenger service at the Airport Border Crossing Point (BCP).
The essence of passenger service BCP. Catalog of necessary objects and functions for building a model in ExtendSim. Case Study 4 - Planning the border control check for passengers using manual booths (MBC) and modern technologies (SSK, e-Gates).

5. Finding the best solution considering multiple criteria.
Planning a simulation experiment. Using the scenario manager. Generating a set of solutions. Making a compromise decision.
6. Summary.
Evaluation of the obtained results (optionally, a test or simulation-based problem solving).

Teaching methods

1. Problem lecture with a multimedia presentation.
2. Workshop methods.
3. Case study.
4. Laboratories - computational experiments.

Bibliography

Basic:
1. Law A.W., Kelton W.D., Simulation Modelling and Analysis. McGraw-Hill Education; 2000, ISBN 978-0071165372.
2. Sawicki P., Symulacje procesów w transporcie lotniczym. E-skrypt udostępniony na eKursy, Politechnika Poznańska, Poznań.
3. Zeigler B.P., Teoria modelowania i symulacji. PWN Warszawa, 1984.

Additional:
1. ImagineThat, ExtendSim - QuickStart Guides. https://extendsim.com/documentation
2. Sawicki P., Sawicka H., Logistics process improvement using simulation and stochastic multiple criteria decision aiding. Procedia - Social and Behavioral Sciences, 2014, vol. 111, no. 5, 1142-1154.
3. Sawicki P., Sawicka H., Zastosowanie metod symulacji i stochastycznego wspomagania decyzji do usprawnienia procesu logistycznego. W: A. Lichota, K. Majewska (red.), Wybrane zagadnienia logistyki stosowanej - Tom I, Wydawnictwa Akademii Górniczo-Hutniczej, Kraków 2013, s. 309-324.
4. Sawicki P., Sawicka H., Żak J., The simulation based solution of the fleet composition problem (FCP) in the fuel distribution network. Conference Proceedings of 23rd European Conference on Operational Research, Bonn, Germany, July 5−8, 2009, s. 74.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	30	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	70	2,50