



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Flight simulation training devices

### Course

Field of study

Aerospace Engineering

Area of study (specialization)

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

2/3

Profile of study

general academic

Course offered in

polish

Requirements

compulsory

### Number of hours

Lecture

9

Laboratory classes

9

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

### Number of credit points

2

### Lecturers

Responsible for the course/lecturer:

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### Prerequisites

Knowledge: Basic knowledge of transport safety, basic knowledge of air transport

Skills: the ability to solve research problems using scientific methods, the ability to find cause and effect relationships based on the acquired knowledge

Social competences: the ability to precisely formulate questions; the ability to define priorities important in solving the tasks set for him; ability to formulate a research problem and search for its solution, independence in problem-solving, ability to cooperate in a group



### Course objective

1. Presentation of the classification of flight simulation devices
2. Presentation of the construction of devices and their components
3. Learning the rules of creating simulator software
4. Discussion of the basics of human physiology important from the point of view of using simulators
5. Presenting the possibility of using simulators to conduct scientific research, train new skills and learn behavior in unusual situations.

### Course-related learning outcomes

#### Knowledge

1. Has extended knowledge necessary to understand the profiled subjects as well as specialist knowledge on construction, operation, air traffic management, safety systems, economic, social and environmental impact in the field of aviation and space - [K1A\_W01]
2. Has detailed knowledge related to selected issues in the field of human capabilities and limitations in aviation and aerospace - [K1A\_W16]
3. Has structured, theoretically founded specialist knowledge in the field of on-board equipment as well as on-board and terrestrial electronic communication systems, remote sensing systems, observation systems, satellite navigation systems - [K1A\_W17]
4. Has a structured, theoretically founded general knowledge covering key issues in the field of flight safety and risk assessment - [K1A\_W22]

#### Skills

1. Can analyze facilities and technical solutions, can search in catalogs and on manufacturers' websites, ready components of machines and devices, including means and devices for transport and storage, assess their suitability for use in own technical and organizational projects - [K1A\_U09]
2. Can plan and carry out a research experiment using measuring equipment, computer simulations, can perform measurements such as temperature measurements with liquid, thermistor, thermocouple thermometers, speed and flow rate using turbine, laser and ultrasonic flow meters, interpret the results and draw conclusions - [K1A\_U10]

#### Social competences

1. Understands the need for lifelong learning; can inspire and organize the learning process of other people - [K1A\_K01]
2. Is ready to critically evaluate the knowledge and content received, recognize the importance of knowledge in solving cognitive and practical problems, and consult experts in the event of difficulties in solving the problem on its own - [K1A\_K02]
3. Is able to interact and work in a group, assuming different roles in it [K1A\_K04]



5. Is aware of the social role of a technical university graduate, and especially understands the need to formulate and transmit to the society, in particular through the mass media, information and opinions on technological achievements and other aspects of engineering activities; makes efforts to provide such information and opinions in a generally comprehensible manner - [K1A \_K08]

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

LECTURE: Assessment of knowledge and skills on a written or oral test based on the explanation of selected issues

LABORATORY: Preparation of reports on the implementation of individual laboratory exercises. Optional assessment of students' knowledge before starting the classes.

### Programme content

LECTURE:

1. Introduction. Basic concepts. Flight simulator and training device definitions. History of flight simulators.
2. Advantages and disadvantages of flight simulation devices: impact on training efficiency, training time reduction, environmental protection, cost reduction and safety.
3. Regulatory regulations for aviation training devices and aviation personnel licensing (CS-FSTD (A) Certification Specifications for Aeroplane Flight Simulation Training Devices, CS-FSTD (H) Certification Specifications for Helicopter Flight Simulation Training Devices).
4. Use of flight simulation devices in pilot training. Characteristics of pilot training. Possibilities of using simulators at different stages of education. Other simulation devices (centrifuge, trainers, mission simulators). Review of existing solutions (aviation, automotive, anti-crisis).
5. Construction of devices and components for simulators. Simulator motion systems: division and construction, principles of construction and basics of control. Visualization systems: image presentation systems, image generation systems, helmet-mounted systems. Image generators. Real-time computer graphics. Computer databases of terrain and 3D objects. Instruments and gauges simulators. Airplane flight control system simulators.
6. Simulator sickness. Factors contributing to the occurrence of the disease, methods of its diagnosis. The causes and symptoms of the simulator disease. Analysis of the construction of simulators used for research purposes at the Poznań University of Technology.
7. Summarizing the acquired knowledge and passing the material.

LAB:

1. Introduction and discussion of health and safety rules.



2. Simulation capabilities. Presentation and discussion of the scope and purposefulness of simulation of selected factors: change of atmospheric conditions, possibilities of simulating the geographical location of the airport, infrastructure, altitude).
3. Simulation possibilities. Presentation and discussion of the scope and purposefulness of simulation of selected factors: simulation of component failure, change of the drive system.
4. Certification of Flight Simulation Training Devices: Validation Tests.
5. Certification of Flight Simulation Training Devices: Functional and subjective tests.
6. Simulator sickness. Discussion of the phenomenon and its causes. Examination of disease symptoms using the SSQ (Simulator Sickness Questionnaire).
7. Test.

### Teaching methods

Informative (conventional) lecture (providing information in a structured way) - may be of a course (introductory) or monographic (specialist) character

Laboratory (experiment) method (students independently conduct experiments)

### Bibliography

Basic

1. Bartnik R., Grenda B., Galej P., Symulatory lotu oraz symulatory kontroli ruchu lotniczego w szkoleniu lotniczym, Wyd. Akademii Obrony Narodowej, Warszawa, 2014
2. Lozia Z.: Symulatory jazdy samochodem, WKŁ, Warszawa 2008
3. Leski J., Symulacja i symulatory, Wyd. MON, Warszawa, 1971
4. Szczepański C., Symulatory lotu, Wyd. Politechniki Warszawskiej, 1990
5. Zagdański Z.: Stany awaryjne statków powietrznych, Wyd. ITWL, Warszawa, 1995
6. Kearns S., Marvin T., Hodge S.: Competency-Based Education in Aviation: Exploring Alternate Training Pathways, 2016
7. J. M. Rolfe, K. J. Staples: Flight Simulation
8. Peter A. Hancock, Dennis A. Vincenzi, John A. Wise, Mustapha Mouloua: Human Factors in Simulation and Training
9. Lewitowicz J., Kustroń K., Podstawy eksploatacji statków powietrznych, Własności i właściwości eksploatacyjne statku powietrznego, Wyd. ITWL, Warszawa, 2003



Additional

1. Safety Management Manual, ICAO Doc 9859 International Civil Aviation Organization, 1st edition 2006
2. Makarowski R., Smolicz T., The human factor in aviation operations, ADRIANA AVIATION, Kosowizna, 2012
3. Lewitowicz J., Kustroń K., Fundamentals of aircraft operation, Aircraft properties and operating properties, Wyd. ITWL, Warsaw, 2003
4. Lewitowicz J. (ed.) Fundamentals of Aircraft Operation, Aircraft Operation Research, Wyd. ITWL, Warsaw, 2007
5. Makarowski R., Risk and stress in sports aviation, Wyd. Difin, Warsaw, 2010

**Breakdown of average student's workload**

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	20	1,0
Student's own work (literature studies, preparation for classes, preparation for the final test) <sup>1</sup>	30	1,0

<sup>1</sup> delete or add other activities as appropriate