COURSE DESCRIPTION CARD - SYLLABUS

Course name

Functioning and research of air transport

Course

Field of study

Aerospace Engineering

Year/Semester

3/5

Area of study (specialization)

Aircraft Transport

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

polish

Form of study

full-time

Requirements

elective

Number of hours

Lecture

45

Laboratory classes

30

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

Number of credit points

6

Lecturers

Responsible for the course/lecturer:

dr inż. Mateusz Nowak

email: mateusz.s.nowak@put.poznan.pl

tel. 61 665 2252

Inżynierii Lądowej i Transportu

ul. Piotrowo 3, 60-965 Poznań

Responsible for the course/lecturer:

dr inż. Waldemar Walerjańczyk

email: waldemar.walerjanczyk@put.poznan.pl

tel. 61 647 59 57

Civil Engineering and Transport

ul. Piotrowo 3 60-965 Poznań

Prerequisites

Knowledge: Basic knowledge of mathematics, physics, mechanics, fluid mechanics, numerical methods, recycling, chemistry, noise emissions, fossil fuel combustion products. He knows the place of air transport in the system of economy, science and relations with other areas of knowledge.

Skills: Able to analyze the interrelationships between the effects and causes of phenomena and events arising from the laws of physics, knows and understands the basic methods and practical tools in the field of air transport description.

Social competences: Prepared for teamwork, knows the limits of own knowledge and skills; can formulate questions precisely, understand the need for further education.

The student demonstrates independence in solving problems, gaining and improving acquired knowledge and skills.

Course objective

Understanding the principles of airport operations and typical problems specific to such complex structures. Mastering the theoretical foundations for identifying, modeling and optimizing the most important airport subsystems. Providing students with information on logistics, definitions and concepts. Students gain knowledge and skills in the field of logistics operation within various industrial and service enterprises, in various branches of transport with particular emphasis on air transport. Detailed knowledge and analysis of ecological problems regarding the use of internal combustion engines in aviation applications. Toxic emissions tests: analysis of existing standards and regulations, and also learning the latest methods for measuring emissions of harmful compounds. Knowledge in the field of 3D modeling of aircraft structures, methods of discretization of geometric models, numerical analysis of designed structures, aerosoelier analysis of aircraft.

Course-related learning outcomes

Knowledge

1. has knowledge in physics, covering the basics of classical mechanics, optics, electricity and magnetism, solid state physics, quantum and nuclear physics, necessary to understand specialist lectures in the field of the theory of construction materials and materials science, the theory of machines and mechanisms, the theory of electric drives and mechatronic systems - [K1A_W02]

2. has basic knowledge in the field of the main departments of technical mechanics: statics of kinematics and material point dynamics as well as rigid body and strength of materials, including the basics of the theory of elasticity and plasticity, stress hypotheses - [K1A_W04]

3. Has structured, theoretically founded knowledge of engineering graphics and machine construction: technical drawing, object projection, basic principles of engineering graphics, the use of CAD (Computer Aided Design) in machine design - [K1_W07]

4. has ordered, theoretically founded general knowledge covering key issues in the field of technical thermodynamics, i.e. the theory of thermodynamic changes, heat flow, heat and cooling machines - [K1A_W10]

5. Has ordered, theoretically founded general knowledge covering key issues in the field of fluid mechanics, in particular aerodynamics, i.e. ideal liquids and gases, viscous Newtonian and non-Newtonian liquids, theory of heat-flow machines - [K1_W11]

6. has detailed knowledge related to selected issues in the field of the most important phenomena occurring in the Earth's atmosphere, the possibility of their prediction, recognition, research, as well as limiting the negative impact of human activities on the surrounding environment - [K1A_W14]

7. Has detailed knowledge related to selected issues in the field of flight rules, its preparation, as well as related operational procedures - [K1A_W17]

8. has detailed knowledge related to selected issues in the field of ground handling of aircraft and propulsion systems, taking into account logistics aspects - [K1A_W19]

9. Has expanded knowledge necessary to understand profile subjects and specialist knowledge about construction, methods of construction, manufacture, operation, air traffic management, security systems, impact on the economy, society and the environment in the field of aviation and space for selected specialties: Air transport - [K1A_W23]

10. Has basic knowledge in the field of law, in particular the law on civil aviation, copyright and industrial property protection and its impact on the development of technology, is able to use patent information resources - [K1A_W25]

Skills

1. Can use formulas and tables, technical and economic calculations using a spreadsheet, and run a simple relational database - [K1A_U05]

2. Is able to carry out a cause and effect analysis of a problem and propose its solution. - [K2A_U08]

3. Has the ability to formulate tasks and stages in air traffic. - [K2A_U07]

4. is able to communicate using various techniques in a professional environment and other environments using the formal record of construction, technical drawing, concepts and definitions of the field of study being studied - [K1A_U02]

5. knows how to use verbal communication with one additional foreign language at the everyday language level, is able to describe the issues of the studied field of study in this language, is able to prepare technical descriptive and drawing documentation of engineering, transport and / or logistics tasks - [K1A_U07]

6. has the ability to self-study with the use of modern teaching tools, such as remote lectures, websites and databases, teaching programs, electronic books - [K1A_U03]

7. is able to obtain information from literature, the Internet, databases and other sources. Is able to integrate the information obtained, interpret and draw conclusions from them as well as create and justify opinions - [K1A_U04]

Social competences

1. Understands the need for lifelong learning; can inspire and organize the learning process of others - [K1A_K01]

2. Is aware of the importance and understands the non-technical aspects and effects of engineering activities, including its impact on the environment, and the associated responsibility for the decisions taken - [K1A_K02]

3. is able to interact and work in a group, assuming different roles in it - [K1A_K03]

4. is able to properly set priorities for implementation of the task specified by himself or other - [K1A_K04]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge in the field covered by the theoretical part will be verified by a semester written assignment (colloquium) while laboratory classes will be based on the presented report on the implementation of tasks.

Programme content

As part of the course, students learn about the basic principles of the operation of airports in both theoretical and practical terms on the example of the operation of the Poznań-Ławica airport. Issues related to the development of air traffic in Poland and its impact on the development of airports and methods of their management and control will be discussed. Typical service operations carried out in the area of the airport, take-off and landing service procedures, passenger and baggage service and related hazards will be characterized. Particular attention will be paid to issues of the functioning of the passenger terminal as well as airport infrastructure and airport equipment. Students will learn about modeling methods for selected processes and traffic streams, as well as tools used in issues related to airport capacity problems. As part of the laboratory classes, they will implement a number of computational experiments using the latest systems supporting modeling and simulation of airport processes (including RAMS Plus recommended by the European Organization for the Safety of Air Navigation Eurocontrol)

Issues related to ecological: production of aircraft engines, their operation and utilization. Technical and economic problems related to recycling.

Issues related to combustion in aircraft engines and formation of harmful compounds, including the division into piston and flow engines. Mechanisms of toxic exhaust components and noise formation. Air traffic organization, general assumptions, and ecological aspects of airport construction.

Methods for measuring toxic compounds, analyzers, particulate measurement, opacimeters. Standards and test methods for the emission of toxic compounds, prognosis for the development of standards and test methods .; on-board emissions testing. Research of aircraft engines on engine dynamometers. Specificity of toxic compounds emission depending on design and operational parameters in aero-piston and flow engines. Reduction of CO2 emissions / fuel consumption in aircraft engines and flying objects. Problems related to noise, basic concepts and relationships, sources of noise in aircraft, noise reduction standards, selected noise measurement methods, noise minimization.

Impact of fuel quality and usability parameters on the emission of toxic substances, conventional fuels, alternative fuels, as well as engine oils.

Overview of pro-ecological aircraft engine constructions and development perspectives.

General definitions of logistics, logistics tasks, outline of logistics history, logistics development phases, logistic customer service and handling, customer service metrics and standards based on selected market segments, comparison of logistics costs in various transport branches, basis for forecasting air transport demand, development perspectives cargo air transport, oversize cargo in air transport.

Presentation of 3D modeling software - SolidWorks, CATIA v5, organization of work in a CAD environment - preparation of models for building discrete models, correctness of definitions in sketching, definition of geometric relations, basic functions of geometry definitions, operations using additional reference geometry, assembly modeling, definition of conditions defining the mutual relations of parts, defining parameters and material properties for parts, defining discrete models for aerial simulations, computer Fluid Mechanics as a tool for simulating the flow of aircraft structures, building structural discrete models based on aircraft structures, analyzing the vibration of discrete models as one of the stages design of aviation structures, algorithm of calculations of aerosollastic aircraft structures, the phenomenon of flutter of aircraft structures on the example of parallel computer simulations.

Teaching methods

Informative (conventional) lecture (transfer of information in a systematic way) - can be of course (propedeutical) or monographic (specialist)

Laboratory (experiment) method (students conduct experiments independently)

Bibliography

Basic

1. Aneks 14 ICAO (International Civil Aviatoin Organization) do Międzynarodowej Chicagowskiej Konwencji Lotnictwa Cywilnego

2. Zarządzanie ruchem lotniczym (PL-4444), Urząd Lotnictwa Cywilnego Warszawa 2006

3. M. Malarski, Inżynieria ruchu lotniczego, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2006

4. Ludomir M. Laudański 15 wykładów aeromechaniki. Wstęp do specjalności lotniczych. Oficyna Wydawnicza Politechniki Rzeszowskiej , Wydanie II 2005

5. Basiewicz T. , Gołaszewski A., Rudziński L., Infrastruktura transportu, Oficyna Wydawnicza Politechniki Warszawskiej, 200

6. Compa T., Zarządzanie przepływem ruchu lotniczego., Dęblin, Wydawnictwo Wyższej Szkoły Szkoły Oficerskiej Sił Powietrznych 2008, Arch. 444583

7. Merkisz Jerzy, Mazurek Stanisław, Pokładowe Systemy Diagnostyczne Pojazdów Samochodowych. Wydawnictwa Komunikacji i Łączności WKŁ, 2006-01-01.

8. Jerzy Merkisz, Ekologiczne problemy silników spalinowych, Wyd. Politechniki Poznańskiej, Poznań 1998.

9. Coyle J., Bardi E., Langley C.: Zarządanie Logistyczne. PWE, Warszawa 2007.

10. Rucińska D., Ruciński A.,Tłoczyński A., Transport lotniczy organizacja i ekonomika. Wydawnictwo Uniwersytetu Gdańskiego 2012

11. Raymond L. Bisplinghoff, Holt Ashley, Robert L. Halfman, "Aeroelasticity" 1996, ISBN: 0486691896

12. Chlebus E.: Techniki komputerowe CAx w inżynierii produkcji, WNT Warszawa 2000

13. Ciałkowski M., Mechanika Płynów, Poznań 2000

14. Rakowski G., Metoda Elementów Skończonych w mechanice konstrukcji, Warszawa 2005

Additional

1. Wojciech Serdecki, Badania silników spalinowych. Wyd. Politechniki Poznańskiej, Poznań 2012

2. Witold M. Lewandowski, Proekologiczne źródła energii odnawialnej. WNT, Warszawa 2002

3. Zdzisław Chłopek, Ochrona środowiska naturalnego. Pojazdy samochodowe. WKŁ, Warszawa 2003

4. Gronowicz J., Ochrona środowiska w transporcie lądowym. Wyd. ITE, Poznań - Radom 2003

5. Jóźwiak Z., Logistyka w transporcie ładaunków ponadgabartowych. Akademia Morska w Szczecinie

6. Kozłowski P., Chakuu S., Nędza M., Podstawy transportu lotniczego. Konsorcjum Akademickie 2012

7. Gryboś W., Mechanika Płynów Cz.1 i Cz.2, PWN, Warszawa

Breakdown of average student's workload

	Hours	ECTS
Total workload	150	6,0
Classes requiring direct contact with the teacher	75	3,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	75	3,0

[1] delete or add other activities as appropriate