COURSE DESCRIPTION CARD - SYLLABUS

Course name

Elements of engine theory, fluid flow and air law

Course

Field of study

Aviation and Astronautics

Area of study (specialization)

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

2/4

Profile of study

general academic

Course offered in

polish

Requirements

compulsory

Number of hours

Lecture

75

Laboratory classes

15

Other (e.g. online)

Tutorials

30

Projects/seminars

Number of credit points

8

Lecturers

Responsible for the course/lecturer:

Leszek Grześkowiak (Elements of engine theory, fluid flow and aviation air law)

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Responsible for the course/lecturer:

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Prerequisites

A student starting this subject should have basic knowledge of aviation law and intellectual property protection. He should also have the ability to apply the scientific method in solving problems and be ready to cooperate within a team.

Mathematics and physics news in the field of study program. The student is able to describe the basic physical phenomena and perform calculations related to them. The student is able to determine the priorities important in solving the tasks set before him. The student demonstrates independence in solving problems, acquiring and improving acquired knowledge and skills.

Basic knowledge of modern aviation and space technology, knowledge of basic physical rules such as energy, momentum and mass conservation

Course objective

To acquaint the student with the activities of Aviation Organizations, regulations on the licensing of aviation personnel, and air traffic management system.

To familiarize students with the theoretical foundations and applications of fluid mechanics.

Build a systematic knowledge of the spectrum of technical solutions for aviation and space propulsion systems. Develop an understanding of the factors determining the choice of propulsion type for the range of flight parameters.

Course-related learning outcomes

Knowledge

1. has knowledge in mathematics, including algebra, analysis, theory of differential equations, probabilistics, analytical geometry necessary to: describe the operation of discrete mechanical systems, understand computer graphics methods, describe the operation of electrical and mechatronic systems

2. 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

3. has ordered, theoretically founded general knowledge covering key issues in the field of fluid mechanics, in particular aerodynamics, i.e. liquids and perfect gases, viscous Newtonian and non-Newtonian liquids, theory of heat-flow machines

4. has detailed knowledge related to selected issues in the field of construction of aviation propulsion systems and design of their components

5. has basic knowledge of the history of aviation and astronautics, especially aircraft and space engines, major events and characters that have contributed to the development of specific fields of science relevant to human development, as well as the latest trends in the construction of machinery and equipment

6. has basic knowledge in the field of law, in particular civil aviation law, copyright law and the protection of industrial property and its impact on the development of technology, is able to use patent information resources

Skills

1. knows how to use native and international languages to the extent that it is possible to understand technical texts and to write using technical dictionaries machine descriptions in the field of aviation and astronautics (knowledge of technical terminology)

2. has the ability to self-study using modern teaching tools, such as remote lectures, websites and databases, teaching programs, e-books

3. knows how to use verbal communication with one additional foreign language at the everyday language level, can describe the issues of the studied field of study in this language, can prepare technical descriptive and drawing documentation of an engineering, transport and / or logistics task

4. is able to carry out elementary technical calculations in the field of fluid mechanics and thermodynamics, such as heat and mass balances, pressure losses in flows around technical flying objects and their modules, select the parameters of fans, compressors and turbines for flow systems, as well as calculate thermodynamic waveforms in heat machines

5. is able to apply basic technical standards regarding unification and safety as well as recycling

Social competences

1. understands the need for lifelong learning; can inspire and organize the learning process of others

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

3. is able to interact and work in a group, taking on various roles in it

4. is able to properly set priorities for the implementation of the task specified by him or others

5. is aware of the social role of a technical university graduate, and in particular understands the need to formulate and communicate to the public, in particular through the mass media, information and opinions on the achievements of technology and other aspects of engineering activities; endeavors to provide such information and opinions in a generally understandable way

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:

- assessment of knowledge and skills demonstrated on the written test - 1.5 hour

Exercises:

knowledge acquired during the exercises is verified by two 45-minute colloquia carried out during 3 and 7 classes

Programme content

Lecture (Elements of engine theory, fluid flow and aviation air law, 30 h):

The Convention on International Civil Aviation (Chicago) - ICAO Doc 7300/9. Convention on the High Seas (Geneva, 29 April 1958), other conventions and agreements. World and European organisations. Airworthiness of aircraft, aircraft nationality and registration marks. Personnel Licensing. Aircraft operations: Departure procedures, Approach procedures, Holding procedures.

Exercises (Elements of engine theory, fluid flow and aviation air law, 15 h):

ICAO Annex 7 - Aircraft Nationality and Registration Marks. Nationality marks, common marks and registration marks. Rules of the air according to ICAO Annex 2 and SERA.

Subject of fluid mechanics. Continuous media model. Some concepts and theorems of fluid kinematics. Power line. Current surface. Fluid element path. Acceleration of fluid element. Substantive, convective and local derivative. Circulation. The principle of mass conservation. Forces affecting the fluid. General motion properties of non-viscous and non-conductive fluids. Fluid statics. Determination of equipotential surfaces and pressure distribution. Liquid pressure on the walls of solids. Swimming and stability of floating bodies.

- The scope and distribution of technical solutions for air and space propulsion

- Definitions of basic unit parameters of aircraft propulsion

- Justification for the choice of propulsion type for its range of use

- Design features of the most popular types of propeller, turbine-jet and rocket propulsion systems

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples given on the board.

2. Exercises: examples given on the board and performance of tasks given by the teacher - practical exercises.

Bibliography

Basic

1. Ustawa z dnia 3 lipca 2002 r. – Prawo lotnicze (Dz. U. z 2013 r. poz. 1393 oraz z 2014 r. poz. 768)

2. Konwencja o międzynarodowym lotnictwie cywilnym, podpisana w Chicago dnia 7 grudnia 1944 r. - Konwencja chicagowska (Dz. U z 1959 r. Nr 35, poz. 212, z późn. zm) wraz z załącznikami

3. Doc 4444 - Zarządzanie ruchem lotniczym

4. Doc 7030/4 - Regionalne Procedury Uzupełniające dla Regionu Europy

5. Doc 8168 - Operacje statków powietrznych

6. Ciałkowski M., Mechanika Płynów. Skrypty Uczelniane. Wydawnictwo Politechniki Poznańskiej.

7. Ciałkowski M., Bartoszewicz J., Frąckowiak A., Grudziński M., Grzelczak M., Kołodziej J., Piątkowski R., Rybarczyk J., Wróblewska A., Mechanika płynów: zbiór zadań z rozwiązaniami, Wydawnictwo Politechniki Poznańskiej, Poznań 2008.

8. Prosnak W.J. Mechanika Płynów, t. I. PWN Warszawa 1971

Additional

1. . Gołębiewski C., Łuczywek E., Walicki E., Zbiór zadań z mechaniki płynów, PWN Warszawa1978

Breakdown of average student's workload

	Hours	ECTS
Total workload	240	8,0
Classes requiring direct contact with the teacher	120	4,0
Student's own work (literature studies, preparation for written tests) [1]	120	4,0

[1] delete or add other activities as appropriate