COURSE DESCRIPTION CARD - SYLLABUS

Course name

Aerodynamics

Course

Field of study

Aerospace Engineering

Year/Semester

1/2

Area of study (specialization)

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

15

Laboratory classes

15

Other (e.g. online)

Tutorials

15

Projects/seminars

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

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Faculty of Environmental Engineering and Energy

Piotrowo 3 st., 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Student should have knowledge of mathematics and physics presented in the studies. He should be able to apply the scientific method in solving problems, carrying out experiments and reasoning, knows the limits of his own knowledge and skills, formulate questions precisely, understand the need for further education.

Course objective

Teaching the basic laws and relationships in the field of aerodynamics and dynamics of aircraft movement and the ability to physically interpret phenomena, as well as familiarizing with the basic equations describing aerodynamic parameters in the flow of solids.

Course-related learning outcomes

Knowledge

1. has knowledge in mathematics, including algebra, analysis, theory of differential equations, analytical geometry necessary to understand and describe the basic issues related to aerodynamics

2. has expanded knowledge necessary to understand the phenomena associated with the aerodynamics of aircrafts and their parts for various aerodynamic systems

3. has ordered, theoretically founded general knowledge covering key issues in the field of fluid mechanics, in particular aerodynamics in the field of incompressible and compressible flows

Skills

1. has the ability to self-study using modern teaching tools, such as websites, e-books and databases of aerodynamic properties of airfoils

2. can use formulas and tables to calculate the aerodynamic forces in the gas flow

3. is able to carry out a research experiment using a wind tunnel and related measuring apparatus, is able to perform measurements, such as measurements of speed, pressure, aerodynamic forces, as well as interpret results and draw conclusions

Social competences

1. is aware of the importance of maintaining the principles of professional ethics during the performance of tests and presenting their results

2. can properly prioritize the implementation of tasks specified by himself or others based on available knowledge in the field of aerodynamics

3. is aware of the effects of aerospace engineering activities, the importance of the correct selection of aircraft components to obtain flows of good quality boundary layer

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written exam from the lecture

Written exam from tutorials

Exam from laboratories based on reports

Programme content

Division of aerodynamic forces, definition of lift and drag, Bernoulli equation. Reynolds number, critical parameters and accumulation of gas, classification of gas flows, change of gas parameters in the flow through a conduit with variable cross-section, wave phenomena in the flow around key parts of external aircraft. normal and oblique shock wave, aviation profile families, aerodynamic characteristics, aerodynamic systems.

PART-66

MODULE 8. BASICS OF AERODYNAMICS

8.1 Atmospheric physics

Application of the International Standard Atmosphere (ISA) for aerodynamics. [2]

8.2 Aerodynamics

Air flow around the body; Boundary layer, stratified flow, turbulent, undisturbed, relative air flow, stream deflection, vorticity, stagnation; Terms: aviation profile, chord, medium aerodynamic chord, profile resistance, resistance induced, pressure center, angle of attack, negative and positive buckling, volatility, wing shape and elongation; Thrust, weight, resultant aerodynamic; Generation of lift and resistance: angle of attack, lift, resistance, polar, stall; Pollution of the airfoil along with ice, snow, frost. [2]

MODULE 11B. AERODYNAMICS, STRUCTURES AND PISTON PLANE SYSTEMS

11.1 Theory of flight

11.1.1. Aircraft aerodynamics and flight control

Action and result: - tilt control: ailerons and air brakes; - height adjustment: headsets, integral tail, variable range ballasts and ducks; - yaw adjustment, rudder stops; Adjustment with the use of airplanes, butterfly tail; Lifting devices, gill slits, gills, flaps, flap hooks; Resistance devices, spoilers, air brakes, speed brakes; Aerodynamic comb lobe effects, fault leading edges; Boundary layer adjustment, vortex generators, stall wedges or leading devices boundary; Operation and effect of balancing flaps, relief and weighting (leading) flaps, flaps steering, spring flaps, mass balance, control surface inclination, aerodynamic adjustment panels. [2]

11.1.2. High-speed flights - not applicable - - [-]

Teaching methods

1. Lecture: multimedia presentation

2. Tutorials: completing the tasks given by the teacher

3. Laboratories: performing measurements and calculations at the testing equipment

Bibliography

Basic

1. Sobieraj W., Aerodynamika, WAT, Warszawa 2014

2. Prosnak W.J., Równania klasycznej Mechaniki płynów, PWN, Warszawa 2006

3. Anderson J.D. Jr., Fundamentals of Aerodynamics, Fifth edition, McGraw-Hill, 2011

Additional

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Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	50	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam) [1]	25	1,0

[1] delete or add other activities as appropriate