

RTU Course "Fundamentals of Aerodynamics"**31000 Faculty of Civil and Mechanical Engineering****General data**

Code	BM0556
Course title	Fundamentals of Aerodynamics
Course status in the programme	Compulsory/Courses of Limited Choice
Responsible instructor	Sergejs Kuzņecovs
Academic staff	Vitālijs Pavelko Aloīzs Lešinskis
Volume of the course: parts and credits points	1 part, 3.0 credits
Language of instruction	LV, EN
Annotation	The study course creates an understanding of the laws of fluid motion and the interaction of their forces with aircraft, the effects of forces and moments on aircraft components during flight, principles of force control and relationship with aircraft geometry, orientation and flight speed, elements of flight dynamics, stability and control theory.
Goals and objectives of the course in terms of competences and skills	The aim of the study course is to acquaint students with the methods, tasks and content of theoretical and experimental aerodynamics, as well as their use for practical purposes. Tasks of the study course: - to provide knowledge about the regularities of theoretical and experimental aerodynamics and research methods. - to develop aerodynamic calculation skills. - to promote the use of aerodynamic knowledge for solving practical problems.
Structure and tasks of independent studies	Processing of experimental data and preparation of laboratory work report. Preparation for test and exam.
Recommended literature	Obligātā/Obligatory: 1. V. Pavelko. Gaisakuģu aerodinamika // Mācību līdzeklis. - Rīga: RTU, 2009. - 258 lpp. 2. I. Pavelko. Aerohidromehānika/Lekciju konspekts. – Rīga: RTU Izdevniecība, 2009. – 94 lpp. 3. JAR CPL Course: 08000- Principles of Flight, 08100- Subsonic Aerodynamics). 1998. - 250 pp. 4. Anderson, J.D. 1991. Fundamentals of Aerodynamics, 2nd ed. McGraw-Hill, New York. 5. Aerodynamics, Aeronautics, and Flight Mechanics, 2/e Barnes W. McCormick// John Wiley & Sons, Inc., 1995 672 pages. 6. Aerodynamics for Engineering Students by E. L. Houghton (Author), Butterworth-Heinemann; 7th edition, 664 pages. Papildu/Additional: 8. EASA Part 66 Module 8 Basic aerodynamics.
Course prerequisites	Material point speed and acceleration. Law of loss of mass of a substance. Movement volume change law. External and internal forces. Newton's laws. Work and energy. Energy Conservation Law.

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Aerodynamic tasks. Liquid and gaseous properties. International standard atmosphere	1	0	0	0
International standard atmosphere.	1	0	0	0
Flow line and flow pipe. Continuity equation. Vortex of fluid.	1	0	0	0
Bernoulli integral. Static and dynamic pressure.	1	0	0	0
The concept of similarity and dimension theory. The main formulas of experimental aerodynamics.	1	0	0	0
Profile aerodynamic coefficients. and pressure coefficient. Aerodynamic characteristics of the profile as a function of the angle of attack.	1	0	0	0
Pressure centre and profile aerodynamic centre (focus).	2	0	0	0
The concept of boundary layer. Laminar and turbulent boundary layer.	2	0	0	0
Geometrical and aerodynamic characteristics of the wing.	2	0	0	0
The concept of inductive resistance. Polar and aerodynamic quality of the aircraft.	2	0	0	0
Wing mechanization.	2	0	0	0
Speed of sound. Mach number, critical Mach number.	2	0	0	0
Control devices.	2	0	0	0
Elements of flight theory: horizontal flight.	1	2	0	0
Elements of flight theory: take-off, landing.	1	2	0	0
Elements of flight theory: take-off, landing.	1	2	0	0
Elements of flight theory: manoeuvres.	1	2	0	0
The concept of stability and handling.	1	2	0	0

Lab. work 1. Air flow velocity measurement.	1	4	0	0
Lab. work 2. Dependence of resistance force on a characteristic area of the body.	1	4	0	0
Lab. work 3. Dependence of resistance force on flow rate.	1	4	0	0
Lab. work 4. Influence of body shape on resistance force.	1	6	0	0
Lab. work 5. Sphere resistance coefficient depending on Reynolds number.	1	6	0	0
Lab. work 6. Factors of wing lifting force and resistance force depending on the angle of application and the angle of installation of the steering wheel. Wing polar.	1	6	0	0
Test. Basic Laws of Atmospheric Physics and Aerodynamics.	1	6	0	0
Total:	32	46	0	0

Learning outcomes and assessment

Learning outcomes	Assessment methods
Can explain the basic laws of atmospheric physics and fluid mechanics.	Test, defence of laboratory works, exam.
Understands the effect of aerodynamic forces and moments on an aircraft.	Defence of laboratory works, exam.
Understands the functions of the main elements of an aircraft.	Exam.
Knows experimental aerodynamic methods.	Defence of laboratory works, exam.
Understands the basic elements of flight theory, stability and controllability.	Exam.
Understands the main effects of supersonic aerodynamics.	Exam.
Knows the principles of experimental data processing and presentation of results.	Defence of laboratory works.

Evaluation criteria of study results

Criterion	%
Test	20
Laboratory works	40
Exam	40
Total:	100

Study subject structure

Part	CP	Hours			Tests		
		Lectures	Practical	Lab.	Test	Exam	Work
1.	3.0	16.0	8.0	8.0		*	