



RTU Course "Computer Methods of Aerodynamics and Strength Calculations"

15E03 Lidaparātu teorijas un konstrukcijas katedra

General data

Code	TAS211
Course title	Computer Methods of Aerodynamics and Strength Calculations
Course status in the programme	Compulsory/Courses of Limited Choice
Course level	Undergraduate Studies
Course type	Professional
Field of study	Transport
Responsible instructor	Pavelko Igors
Academic staff	Pavelko Vitālijs
Volume of the course: parts and credits points	1 part, 2.0 Credit Points, 3.0 ECTS credits
Language of instruction	LV, EN, RU
Possibility of distance learning	Not planned
Abstract	The subject is covering such issues as the theory of potential flows and its applications to solving specific problems. Laplace equation and its solution. Estimation of a flow velocity field around a body. Estimation of pressure distribution on a surface of a body and of aerodynamic forces acting. Airfoil in incompressible flow. Loading conditions. Estimation of stress and strain conditions of a body by a finite element method. Analysis of strength of aircraft components.
Goals and objectives of the course in terms of competences and skills	Acquire theoretical knowledge of aerodynamic calculations of structural elements of aircraft glider based on the theory of potential flows. Acquire practical skills of MATLAB aided computer modelling and calculation of airfoils. Acquire practical skills of determination of loads acting on the structural elements of aircraft glider. Acquire theoretical knowledge of fundamentals of the finite element method. Acquire practical skills of the finite element software (Autodesk Inventor, Autodesk Mechanical Desktop) application in calculations of strength of structural elements of aircraft glider.
Structure and tasks of independent studies	Preparation of reports of calculation-graphic works: <ul style="list-style-type: none"> • aerodynamic calculations of wing airfoil and determination of wing load (6 h.); • revision of strength of elements of wing structure (6 h.) Working with the literature (4 h.)
Recommended literature	<ol style="list-style-type: none"> 1. I.Pavelko, V. Pavelko. Aerohidromehānika / Metodiskie norādījumi laboratorijas un aprēķinu - grafiskajiem darbiem. - Rīga: RTU Izdevniecība, 2006. - 31 lpp. 2. Seven T. Karris. Signals and Systems with MATLAB&Applications. Second Edition., ISBN 0-9709511-8-3, Orchard Publications, 2003. 3. Autodesk Inventor-2008. 4. Rižikov Ju. I. Rešēnīje naučno-tehničeskīh zadač na personalnom kompjutere. - CP6.: KORONA print, 2000.
Course prerequisites	Fundamentals of theory of potential flows. Aerodynamic forces, moments and their coefficients. Basic knowledge of aircraft construction. Mechanical stress and factors of load.

Course outline

Theme	Hours
Airfoil and wing geometrical characteristics.	1
Zhukovsky lift theorem. Kutta postulate.	1
Pressure center and focus. Pressure coefficient and its correlation to aerodynamic coefficients.	1
Application of theory of potential flows to determine lift of airfoil.	1
Aerodynamic analysis of a wing profile in the ideal incompressible two-dimensional parallel flow.	6
Determination of derivatives of lift, pitching moment and pressure drag coefficients under angle of attack.	2
Estimation of friction drag coefficient of a wing profile in real flow.	2
Influence of compressibility on airfoil and wing characteristics.	1
Correction of calculated aerodynamic characteristics for real compressible flow.	1
Construction and schemes of loading of a wing.	4
Introduction to the finite element method.	4
Determination of load of elements of a wing structure.	2
Autodesk Inventor un Autodesk Mechanical Desktop aided revision of strength of elements of a wing structure.	6

Learning outcomes and assessment

Learning outcomes	Assessment methods
The student is able to apply MATLAB software and special NACA calculators to determine aerodynamic characteristics of a wing profile.	Calculation-graphic work: Aerodynamic calculations of a wing profile and determination of a wing load.

The student is able to apply the finite element program products in calculation of strength of elements of wing structure.	Calculation-graphic work: Assesment of strength of elements of wing structure.
The student knows the methods of aerodynamic calculations of structural elements of aircraft glider.	Exam.
The student knows the fundamentals of the finite element method. The student is able to solve standard tasks of aerodynamics and strength modern computer software.	Exam.

Study subject structure

Part	CP	ECTS	Hours per Week			Tests		
			Lectures	Practical	Lab.	Test	Exam	Work
1.	2.0	3.0	0.5	1.5	0.0		*	