RTU Course "Applied Continuum Theory"

15E03 Lidaparātu teorijas un konstrukcijas katedra

General data

Code	TAS515
Course title	Applied Continuum Theory
Course status in the programme	Compulsory/Courses of Limited Choice
Course level	Post-graduate Studies
Course type	Academic
Field of study	Mechanics, Mechanical Engineering, Machine Building
Responsible instructor	Pavelko Vitālijs
Academic staff	Pavelko Igors
Volume of the course: parts and credits points	1 part, 3.0 Credit Points, 4.5 ECTS credits
Language of instruction	LV, EN, RU
Possibility of distance learning	Not planned
Abstract	Fundamentals of continuum theory, and hypotheses are discussed. All common parts of the theories are considered: stresses theory, kinematics of continuum and its versions, motion equation of continuum. The second part of a course includes basic laws of continuum: solid elasticity, fluid and gas, ionic substance, piezoelectricity. In the third part application of the analytical and numerical methods is considered mainly for fluid and gas dynamics.
Goals and objectives of the course in terms of competences and skills	The main goal: to introduce students with the fundamentals of continuum theory, its structure, parts, basic laws of the branches, and the methods of solving. As a result, students acquire abilities to analyze some real problem and to formulate the conditions of continuum theory application, to execute a reasonable choice of parameters of the model (geometry, continuum properties, boundary conditions), to analyze the result of solution by standard computerional programs.
Structure and tasks of independent studies	Preparation of reports on homeworks: analysis of mass conservation law (2 h); analysis of fundamental potential flow (2h) solution of Laplas equation for potential flow by finite element method (2 h); Working with the literature (10 h).
Recommended literature	1. V.Pavelko. Lietišķā kontinuuma teorija: lekciju konspekts. - Rīga, RAU: 1998.- 75 lp. 2. L.Sedovs. Continuum mechanics: V.1 and 2. - M.:1997.- 560, 544 pp. 3. C.Truesdell. A First Course in Rational Continuum Mechanics// The Johns Hopkins University, Baltimore, Maryland, 1972.-592 pp. 4. Л.И.Седов. Механика сплошной среды. – В двух томах. М.: Наука, 1973. – 1том 536 с., 2том 581 с. 5. Х. Хан. Теория упругости. – М.: Мир, 1988. – 344 с. 6. Н.И. Мусхелишвили. Некоторые основные задачи математической теории упругости. – М.: Наука, 1966. – 707 с. 7. ELECTROMAGNETIC FIELD THEORY EXERCISES by Tobia Carozzi, Anders Eriksson, Bengt Lundborg, Bo Thidé and Mattias Waldenvik (2009) Freely downloadable from www.plasma.uu.se/CED 8. Piezoelectricity. http://en.wikipedia.org/wiki/Piezoelectricity 9. Setter, N (Ed). Piezoelectric Materials in Devices. EPFL-LC, 2002.
Course prerequisites	Mathematics, physics, mechanics, aerohydromechanics, aircraft aerodynamics.

Course outline

Theme	Hours
Fundamentals of continuum theory.	2
Stresses theory.	4
Equilibrium and movement equations.	4
Kinematics of continuum.	6
Basic laws of continuum.	4
Theory of elastisity.	2
Fluid and gas theory.	4
Navije-Stocks equations.	6
Potential flow.	8
Maxwell elecrtodynamics.	2
Megnetohydrodynamics.	2
Piezoelectrisity.	4

Learning outcomes and assessment

Learning outcomes	Assessment methods
The student is able to analyze a technical problem or natural phenomenon and formulate its solution way using corresponding branch of the continuum theory.	Periodic test, overview of a technical problem or natural phenomenon during training and estimation of the selected solution method.

The student is able to solve basic problems of the continuum kinematics.	Periodic test, estimation of selection of solving method for problems of the continuum kinematics.
The student is able to solve basic problems of the solid continuum.	Training results estimation, exam.
The student is able to solve problems of the potential flow, using MATLAB.	Training results estimation, exam.
The student is able to formulate problems of the viscous fluid flow and to select corresponding numerical method of analysis.	Periodic test, exam.

Study subject structure

Part	CP	ECTS	Hours per Week			Tests		
			Lectures	Practical	Lab.	Test	Exam	Work
1.	3.0	4.5	2.0	0.5	0.5		*	