



## RTU Course "Design Automation of Machines"

15E01 Aeronautikas tehnoloģiju katedra

### General data

Code	TAS502
Course title	Design Automation of Machines
Course status in the programme	Compulsory/Courses of Limited Choice; Courses of Free Choice
Course level	Post-graduate Studies
Course type	Academic
Field of study	Mechanics, Mechanical Engineering, Machine Building
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	General parameters of operation of the internal combustion engine and their interrelations. Performance of digital computers and program of maintenance. Graphic modes and user interface. Graphic object. Deposition of dimensions. Development of 3D models of solid bodies and surfaces. Constraints and their realization in computer design. Assembly. Simulation of mechanism motion using 3D computer models. Test calculations and determination of dimensions of elements.
Goals and objectives of the course in terms of competences and skills	Acquire skills to work with modern computer software products. Learn the methodology of design and test calculations of specific mechanisms and its implementation.
Structure and tasks of independent studies	Computer aided calculation of structural dimensions of a crank mechanism (2h.) Development of the computer aided sketch design of a crank mechanism (4h.) Computer aided calculation of dynamics of a crank mechanism (4h.) Computer aided calculation of strength of the crankshaft (4h.) Analysis of the strength calculation result and elaboration of values of structural dimensions (2h.)
Recommended literature	<ol style="list-style-type: none"> <li>1. COMPUTER-AIDED DESIGN, ENGINEERING, AND MANUFACTURING: Systems Techniques And Applications, 2001 by CRC Press LLC Boca Raton London New York Washington, D.C. , -285 pages.</li> <li>2. Traktoru un automobiļu motoru konstrukcija, teorija un aprēķins LLA lauksaimn. mehanizācijas fak. studentiem [J. Blīvis, V. Gulbis, J. Kažoks, V. Kleins, G. Melgalvs, L. Ozoliņa, L. Pēks, G. Pommers] J. Kažoka, G. Melgalva red. Rīga: Zvaigzne 1980 - 373 lpp.</li> <li>3. M. Banovs, I. Pavelko. Virszemes transporta dzinēju stiprība (Virzuļu dzinēju stiprība)/ Lekciju konspekts. – Rīga: AI RTU, 2001. – 58 lpp. ISBN 9984-690-16-4</li> <li>4. "AutoDesk Inventor" help.</li> <li>5. "Mechanical Desktop" help.</li> <li>6. Books / LabVIEW Digital Signal Processing.// Hardcover: Publisher: McGraw-Hill Professional; 1 edition (May 6, 2005), Language: English, ISBN: 0071444920, -205 pages.</li> </ol>
Course prerequisites	Using computer aided analysis machines and mechanisms. Computer design of elements, kinematic pairs and chains. Sketch and sketch plane. Work point, work axis and work plane. Calculation of the kinematic characteristics of mechanisms, using computer simulation results. Speeds and accelerations definition for points and parts of mechanisms. Dynamics analysis of mechanisms.

### Course outline

Theme	Hours
Task to design a crank mechanism. A parametric choice of the crankshaft dimensions.	2
Computer aided calculation of structural dimensions of a crank mechanism in Microsoft Excel.	2
Development of computer aided models of crankshaft and connection rod in AutoDesk Inventor.	4
Development of computer aided models of piston group elements in AutoDesk Inventor.	4
Development of computer aided models of crankcase and cylinder block in AutoDesk Inventor.	2
Development of crank mechanism assembly model in AutoDesk Inventor.	4
Theory of kinematic and dynami calculation of a crank mechanism.	2
Calculation of loads applied to the elements of a crank mechanism in Microsoft Excel.	4
Theory of crank mechanism strength calculation.	2
Crank mechanism strength calculation in Mechanical Desktop.	4
Analysis of the strength calculation results. Elaboration of values of the structural dimensions.	2

### Learning outcomes and assessment

Learning outcomes	Assessment methods
Able to determine structural dimensions of the crank mechanism based on the specification data offered.	Test: Development of computer aided sketch design of the crank mechanism.

Able to develop computer aided models of the crank mechanism elements and their assembly.	Test: Development of computer aided sketch design of the crank mechanism.
Able to determine loads acting on the crank mechanism.	Test: Computer aided calculation of dynamics of the crank mechanism and strength of the crankshaft.
Able to calculate strength of the crank mechanism by the finite element method.	Test: Computer aided calculation of dynamics of the crank mechanism and strength of the crankshaft.
Able to use modern computer software products to solve tasks of specific objects' design.	Test.

***Study subject structure***

Part	CP	ECTS	Hours per Week			Tests			Tests (free choice)		
			Lectures	Practical	Lab.	Test	Exam	Work	Test	Exam	Work
1.	2.0	3.0	1.0	1.0	0.0		*		*		