RTU Course "Fundamentals of Graphics Communication"

31000 Faculty of Civil and Mechanical Engineering

General data

Code	BTG701
Course title	Fundamentals of Graphics Communication
Course status in the programme	Compulsory/Courses of Limited Choice; Courses of Free Choice
Responsible instructor	Modris Dobelis
Academic staff	Zoja Veide Ieva Jurāne Veronika Stroževa Dmitrijs Ļitvinovs
Volume of the course: parts and credits points	1 part, 3.0 credits
Language of instruction	LV, EN
Annotation	Students learn the theoretical issues of geometry and engineering graphics (drawing) and practical skills for creating spatial models, with which various digital simulations can be performed in the future. The study course provides practical skills for creation of 3D models of equipment and preparation of technical documentation in the classical "pencil" technique, as well as in computer-aided design or CAD programmes which support the PLM (Product Lifecycle Management) concept. The theoretical knowledge acquired in the study course is practically supported with a computer-aided design software SolidWorks, which uses parametric feature-based modeling approach, virtual assembly of components, acquisition of working and assembly drawings from digital models, as well as preparation of other types of project graphic communication documents, including for 3D printing. The study course concludes with the acquaintance of a wide range of virtual simulation options and, in accordance with the specifics of a particular study programme, practically solve entry-level simulation tasks. The tasks include virtual assembly along with analysis of kinematics of mechanism and interference detection of components, simulation of flow and mass transfer processes, as well as design of technological equipment with pipelines. Students will be able to use the acquired skills more fully after mastering the theoretical issues corresponding to the field of study in the later specific study courses, in which the creation of required virtual 3D models will not considered. The study course may be used as a core study course for mastering the basic issues of engineering graphics necessary for the creation of 3D geometric models of the equipment by means of a widely applied and intuitively easy to use CAD software.
Goals and objectives of the course in terms of competences and skills	The aim of the study course is to acquaint with the spatial communication of 3D engineering objects by means of drawings or 2D documents, as well as by means of 3D models or digital prototypes. The tasks of the study course are to provide knowledge about the creation of sketches, drawings and 3D models, to develop the skills of interpretation or reading of drawings, to provide insight into a wide variety of virtual simulations.
Structure and tasks of independent studies	Homeworks on provided templates to master basic engineering graphics skills. Sketching exercises to master spatial comprehension. Completion of practical CAD tasks. Preparation for tests and CAD laboratory work. Creation of part models according to working and assembly drawings. Reverse engineering project on a selected topic - creation of product parts and assembly models.
Recommended literature	Obligātā/Obligatory: 1. Auzukalns J., Dobelis M., Fjodorova G., Jurāne I., Leja E., Stroževa V., Veide G., Veide Z. Inženiergrafika. Mācību līdzeklis inženierzinātņu studentiem. Rīga: RTU Izdevniecība, 2008. -310 lpp. 2. Bertoline G., Wiebe E., Hartman N., Ross W. Fundamentals of Graphics Communication. McGraw-Hill Higher Education, 2010. -778 p. 3. Čukurs J., Nulle I., Dobelis M. Inženiergrafika. Mācību grāmata inženiertehnisko specialitāšu nepilna laika un tālmācības studiju studentiem Jelgava: LLU, 2008. -416 lpp. 4. E-studiju vidē publicētie tematiskie apkopojumi (pdf formāts) / Compendiums Papildu/Additional: 5. Lieu D.K., Sorby Sh. Visualization, Modeling, and Graphics for Engineering Design. 2nd ed. Cengage Learning, 2017. -722 p. 6. SolidWorks 2020. Step-By-Step Guide. CADFolks, 2020. -430 p. 7. Duhovnik J., Demšar I., Drešar P. Space Modeling with SolidWorks and NX. Springer International Publishing Switzerland, 2015. -499 p. Citi informācijas resursi/Other information resources: SolidWorks oficiālā mājas lapa, portāli un blogi.
Course prerequisites	Computer literacy skills, knowledge of geometry, and mathematics.

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Graphics communication in IT age. PLM concept in engineering. Methods of projection and modeling of engineering objects.	2	2	1	4
Constructions of 2D geometric element. 3D geometric primitives, their models and projections on the plane.	2	3	1	4

Sketching and drawings or multi-view projections: views, sections, dimensioning.	2	3	1	4
Parametric sketches. Main feature based modeling methods - Extrude, Rotate, Loft and Sweep. Boolean operations with geometric primitives.	4	6	2	8
Separable and non-separable joints. Threads, their conventional representation in drawings and models.	4	4	1	6
Interpretation or reading of drawings. 3D modeling according to Bottom-Up and Top-Down strategies.	4	4	1	6
Assembly models and assembly of parts in an Assembly mode. Types of mates and degrees of freedom.	4	4	2	8
Documentation of virtual models in a Drawing mode: creation of views, sections and other types of drawing images, display of dimensions, generation of bill of materials.	4	4	2	8
An overview of the possibilities of digital simulations of virtual models. Publication of 2D and 3D communication documents.	2	2	1	6
A virtual simulation dedicated for particular study program: kinematics of moving elements, analysis of interference, flow simulation or design of equipment with pipelines.	4	6	2	8
Consultations and exam.	8	2	2	2
Total:	40	40	16	64

Learning outcomes and assessment

Learning outcomes	Assessment methods
Able to recognize geometric primitives in nature and drawings and create 3D models and drawings of the equipment. Understands the difference between 2D drawing and 3D parametric modeling.	Evaluate a spatial comprehension in a test.
Able to create part sketches in pencil technique and provide the necessary sectional view and section information, as well as determine and specify the dimensions required for manufacturing or modeling.	The ability to create correct sketches and drawings, as well as the graphic culture of their execution, is assessed in individual works.
Able to use parametric fully defined sketches, independently select modeling features and define their parameters, is able to create from successive features a design tree of a 3D model for equipment.	The conformity of 3D computer models to the requirements is assessed in individual works.
Understands the concept of design intent and is able to compile a geometry parameter optimization tasks for equipment simulations using variables and equations.	The conformity of 3D computer models to the requirements is assessed in individual works.
Able to create a reverse engineering project - analyse a product or equipment, identify its components, choose a modeling strategy, create part and assembly models.	Evaluate the scope of individual reverse engineering project and its presentation skills, answers to questions.

Evaluation criteria of study results

Criterion	%
Test on spatial comprehension	10
Compliance of pencil sketches and drawings with standards	10
Correspondence of 3D computer models to the originals	30
The scope of reverse engineering project and its presentation skills	50
Total:	100

Study subject structure

Part	CP	Hours			Tests			Tests (free choice)		
		Lectures	Practical	Lab.	Test	Exam	Work	Test	Exam	Work
1.	3.0	0.5	0.5	1.0		*				*