RTU Course "Materials Science"

32000 Faculty of Natural Sciences and Technology

General data

Code	DA0014
Course title	Materials Science
Course status in the programme	Compulsory/Courses of Limited Choice; Courses of Free Choice
Responsible instructor	Dagnija Loča
Volume of the course: parts and credits points	1 part, 4.0 credits
Language of instruction	LV, EN
Annotation	Within the study course, different classes of materials will be examined, starting with more traditional ones, which include metal and wood, and ending with new and innovative ones, which include nanomaterials, biomaterials and intelligent materials. Emphasis is placed on the characterization of material properties and the research and analysis of processes taking place in materials with the aim to understand the connection of material properties with their potential applications in various engineering solutions.
Goals and objectives of the course in terms of competences and skills	The aim of the study course is to improve the student's understanding of different material classes and material properties, emphasizing the processes in materials with the aim to deepen students understanding of the connection of material properties with their potential applications in various engineering solutions. Tasks of the study course: 1. To create an understanding of the fundamental laws of nature and the structure of matter, applying the elements of higher mathematics. 2. To develop a physical- technical perception of the world and logical thinking. 3. To develop skills to orientate in classical and modern physics, astronomy and materials science, and the latest achievements in these scientific areas, as well as their application in solving various technical problems, including high value-added technologies.
Structure and tasks of independent studies	Within the study course, students independently develop individual practical work.
Recommended literature	Obligātā/Obligatory: 1. James F. Shackelford (2016), Introduction to materials science for engineers. Boston: Pearson. 2. William F. Smith, Javad Hashemi (2011), Foundations of materials science and engineering. Dubuque, IA: McGraw-Hill. 3. W.D.Callister. Materials science and engineering: an introduction; John Wiley&Sons, Inc.: USA, 2007, 721 p. Papildu/Additional: 1. Donald R. Askeland, Pradeep P. Fulay (2010), Essentials of materials science and engineering. Australia; Cengage Learning. 2. James F. Shackelford (2009), Introduction to materials science for engineers. Upper Saddle River, New Jersey: Pearson/Prentice Hall. 3. Michael Ashby, Hugh Shercliff, David Cebon (2007), Materials engineering, science, processing and Design. Oxford, UK; Burlington, MA: Butterworth-Heinemann/ Elsevier.
Course prerequisites	Math, Physics, Chemistry.

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Course schedule, test and examination schedule, individual/group presentation schedule, student evaluation principles. Introduction - what is materials science?	4	4	0	0
Structure of materials (atomic structure, crystalline and amorphous substances, defects in materials).	8	4	0	0
Materials properties (electrical, magnetic, optical, acoustic, thermal and mechanical properties).	12	4	0	0
Classification of materials (metal, wood, glass, ceramic, polymers, composite materials, biomaterials, nanomaterials).	18	4	0	0
Practical work - Properties of materials, practical use and application possibilities taking into account the specific properties.	5	10	0	0
Practical work - Description of the materials used in the manufacturing of certain products. The search for alternative materials.	5	10	0	0
1. Test: Structure of materials.	2	6	0	0
2. Test: Materials properties.	2	6	0	0
3. Test: Classification of materials.	4	12	0	0
Total:	60	60	0	0

Learning outcomes and assessment

Learning outcomes	Assessment methods
Is able to understand the relationships among materials structures and their properties.	1. Test — structure of materials, deviations from ideal structure. 2. Test- material properties. 3. Work during the lectures, discussions and quizzes. 4. Exam.
Is able to orient in different material classes and ability to identify properties of each material class.	1. Test – classification of materials. 2. Work during the lectures, discussions, and quizzes. 3. Exam.
Is able to link the properties of the materials to their application and to find an alternative to improve material performance and properties for the dedicated application, using the knowledge gained during the course and available literature sources.	1. Presentation on design, characteristics of the product/item and its applications and alternatives. 2. Exam.
Is able to use obtained skills to solve the theoretical problems.	1. Individual work.

Evaluation criteria of study results

Criterion	%
Work during the lectures, discussions and quizzes.	20
Test 1	15
Test 2	15
Test 3	15
Individual work/presentation	15
Exam	20
Total:	100

Study subject structure

Part	CP	Hours			Tests			Tests (free choice)		
		Lectures	Practical	Lab.	Test	Exam	Work	Test	Exam	Work
1.	4.0	40.0	20.0	0.0		*			*	