RTU Course "Identification and Analysis of Polymer Materials"

32000 Faculty of Natural Sciences and Technology

General data

Code	ĶPI732
Course title	Identification and Analysis of Polymer Materials
Course status in the programme	Compulsory/Courses of Limited Choice; Courses of Free Choice
Responsible instructor	Sergejs Gaidukovs
Academic staff	Agnese Ābele Anda Gromova
Volume of the course: parts and credits points	1 part, 6.0 credits
Language of instruction	LV, EN
Annotation	The student acquires in-depth knowledge of polymer material identification, analysis and testing, as well as data processing and evaluation. The student learns to choose the right analysis methods for homopolymers, copolymers, polymer blends, thermoplastic and thermosetting polymer composites and nanocomposites. By analysing and testing polymer material in various deformation states, physical states and also in a wide temperature range, the student learns to critically evaluate the obtained experimental information, analyze experimental data and make assumptions about the structure of polymer material.
Goals and objectives of the course in terms of competences and skills	The aim of the study course is to develop in-depth theoretical knowledge and practical skills of the main methods of material identification and analysis. The tasks of the study course are to develop the following skills - to be able to independently perform polymer structures, surfaces, mechanical, thermal, rheological, permeability, etc. property analysis; be able to choose the most appropriate testing method, evaluate the obtained quantitative and qualitative information, perform mathematical analysis of data and draw conclusions.
Structure and tasks of independent studies	Independent study of study literature and solving practical tasks, preparation for tests and discussions, and preparation of an individual task presentation. Preparation for laboratory work, using theoretical knowledge gained in lectures and independently. Processing and design of laboratory work results. Completion of homework. As a result of independent work, the student must present a detailed report on polymer materials analysing experimental data and the latest scientific literature.
Recommended literature	Obligātā/Obligatory: Barbara H. Stuart. Polymer analysis. John Wiley & Sons, 2002. 279 p. Michael Bolgar, Jack Hubball, Joseph Groeger, Susan Meronek.. Handbook for the Chemical Analysis of Plastic and Polymer Additives. CRC Press, 2015. Papildu/Additional: Richard A. Pethrick. . Polymer Structure Characterisation: From Nano To Macro Organization. Royal Society of Chemistry, 2007. 345 p. H.Zweifel, R.D.Maier, M.Schiller. . Plastics Additives Handbook. Hanser, 2009. 1222 p. T.R.Crompton. . Characterisation of Polymers. Smithers Rapra Technology, 2008. 492 p.
Course prerequisites	Basic knowledge of polymer chemistry and technology at the bachelor's level.

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Basic groups of polymeric materials and their most important physical and chemical parameters.	2	3	0	0
Identification of polymeric materials.	2	3	0	0
Analysis of polymerization and polycondensation process.	2	3	0	0
Analysis of mechanical properties.	4	6	0	0
Analysis of polymer additives and fillers.	2	3	0	0
Thermal analysis. Degradation analysis. Biodegradation analysis.	4	6	0	0
Analysis of permeability and sorption properties. Analysis of rheological properties.	4	6	0	0
Spectroscopy, diffraction and chromatography analysis.	4	6	0	0
Structure (morphology) analysis. Surface analysis. Methods of complex research of polymer materials.	4	6	0	0
Seminar. Presentation of individual works and tasks.	4	6	0	0
Laboratory work. Unknown polymer identification. Microscopic analysis of polymers and their composites.	8	12	0	0
Laboratory work. Characterization of polymers by DSC and TG analysis methods.	8	12	0	0
Laboratory work. Rheological properties. Determination of melt index.	8	12	0	0
Laboratory work. Analysis of mechanical properties.	8	12	0	0
Total:	64	96	0	0

Learning outcomes and assessment

Learning outcomes	Assessment methods
Knows the chemical structures of polymer chains, micro- and macrostructure analysis of polymer material and methods of testing polymer material properties.	Types of examination: homework, exam, individual work, laboratory works. Criteria: is able to describe and define the application of test methods for polymer materials, polymer blends and polymer composites.
Is familiar with the analysis of the morphological structure of polymeric materials.	Types of tests: laboratory works, individual work. Criteria: is able to independently apply the acquired theoretical knowledge and problem-solving skills, knows the application of analysis and testing methods.
Is able to independently apply practical knowledge in the identification of polymer materials.	Types of tests: laboratory works. Criteria: knows the methods of identification of polymer materials and is able to identify different polymers in the laboratory.
Focuses on testing the thermal, mechanical, permeability and rheological properties of polymer materials.	Types of tests: laboratory works. Criteria: is able to perform analysis of various polymers in the laboratory.

Evaluation criteria of study results

Criterion	%
Exam	50
Laboratory works	30
Homework, individual works	20
Total:	100

Study subject structure

Part	CP	Hours			Tests			Tests (free choice)		
		Lectures	Practical	Lab.	Test	Exam	Work	Test	Exam	Work
1.	6.0	2.0	0.0	2.0		*			*	