COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) title	Code
Physical Chemistry Experimental Course	

Lecturer(s)	Department(s) where the course unit (module) is delivered
Coordinator: Deivis Plaušinaitis **Other(s):**	Department of Physical chemistry, Vilnius University

Study cycle	Type of the course unit (module)
Bachelor	

Mode of delivery	Period when the course unit (module) is delivered	Language(s) of instruction
Face to face		English

Requirements for students	
Prerequisites: General Chemistry	**Additional requirements (if any):**

Course (module) volume in credits	Total student's workload	Contact hours	Self-study hours
5	134	64	70

Purpose of the course unit (module): programme competences to be developed		
This course is designed to support theoretical course of Physical chemistry by laboratory practice. Its aim is to build up practical skills in laboratory technique and to give deeper understanding in theoretical topics. Experiments in this course deal with following topics: properties of solution, solubility dependence on temperature, enthalpy of dissolution, solubility product constant; colligative properties of solution, molar mass determination by freezing point depression, chemical equilibrium, determination of equilibrium constant of chemical reaction, equilibrium in electrolyte solution, determination of ionization constant of weak acid, chemical kinetics, investigation of rate of the reaction, determination order and rate constant of the reaction, reaction rate dependence from temperature, determination of energy of activation, electrochemical equilibrium, electrochemical cell potential dependence from electrolyte concentration, standard oxidation-reduction potential, determination of ions diffusion constant.		
Learning outcomes of the course unit (module)	**Teaching and learning methods**	**Assessment methods**
Successful completion of this course the student will be able to: • Calculate the molar mass of the substance from the solution freezing point depression. • Describe the chemical equilibrium, perform the calculations in witch requiring the equilibrium constant; • From the experimental data to determine the reaction rate and to evaluate the degree of reaction. • Determine the titration curve of the weak acid or weak base. • From the experimental data of the specific conductivity of solution calculate the dissociation constant of the substance.	Laboratory work; Writing of laboratory work reports; Textbook reading	All laboratory works must be done, laboratory reports must be compiled and defended.

Content: breakdown of the topics	Contact hours							Self-study work: time and assignments	
	Lectures	Tutorials	Seminars	Exercises	Laboratory work	Internship/work placement	**Contact hours**	**Self-study hours**	**Assignments**
Molar mass determination using freezing point depression. Colligative properties of the solutions. Solution freezing point depression.		1			6		**7**	**7**	Textbook reading. Preparation of laboratory work report.
Determination of equilibrium constant for reaction. Chemical equilibrium. Effect of temperature and concentration on equilibrium.		1			6		**7**	**8**	Textbook reading. Preparation of laboratory work report.
Determination the order of the reaction.		1			5		**6**	**7**	Textbook reading. Preparation of laboratory work report.
Ester hydrolysis rate constant determination. Effect of temperature and concentration on chemical rate. Activation energy.		1			7		**8**	**8**	Textbook reading. Preparation of laboratory work report.
Enzyme catalysis. Derivation and Analysis of the Michaelis-Menten Theory.		1			7		**8**	**8**	Textbook reading. Preparation of laboratory work report.
Conductance of weak electrolyte. Molar conductivity and the degree of dissociation of the acid solutions. Define the first step dissociation constant of the acid		1			6		**7**	**8**	Textbook reading. Preparation of laboratory work report.
Titration of amino acid. Determination the amino acid acid-base groups ionization constants *pK* and isoelectric point *pI*.		1			6		**7**	**8**	Textbook reading. Preparation of laboratory work report.
Determine the transport numbers of the cation and anion of oxygen acid ($HClO_3$, H_2SO_4 or H_3PO_4).		1			6		**7**	**8**	Textbook reading. Preparation of laboratory work report.
Isoelectric point of gelatin. Determination the solution viscosity.		1			6		**7**	**8**	Textbook reading. Preparation of laboratory work report.
Total		**9**			**55**		**64**	**70**	

Assessment strategy	Weight,%	Deadline	Assessment criteria
Laboratory work	100 %	Every week	All laboratory works must be done, laboratory reports must be compiled and defended in one-to one conversation with laboratory teacher. In case of Fail, student must repeat laboratory work.

Author	Year of publication	Title	Issue of a periodical or volume of a publication	Publishing place and house or web link
Compulsory reading				
P. Atkins, J. de Paula	2006	Physical Chemistry	8th edition.	Oxford University Press, Oxford.
P. Atkins, J. dePaula.	2011	Physical Chemistry for the Life Sciences	2nd edition.	Oxford University Press, Oxford.
Silbey R.J., Albertty R.A., Bawendi M.G,	2005	Physical chemistry	4th edition.	J.Wiley & Sons
Optional reading				
P. Atkins, L. Jones.	2010	Chemical Principles: The Quest for Insight	5th edition.	H.W.Freeman and co.