Course	**Physical and Colloidal Chemistry I**
Course code	*Ķīmi2003*
Scientific discipline	Chemistry
Scientific sub-branch	Physical chemistry
Credits	4
ECTS credits	6
Total number of study room hours	64
Number of lecture hours	32
Seminars and practical work hours	-
Number of hours of laboratory work	32
Number of hours allocated for the term paper	-

Author of the course
Dr. Chem., Assistant Professor Sergejs Osipovs

Background knowledge (course title, part of the program where the course is to be completed)
General Chemistry; Inorganic chemistry;

Course abstract:
The aim of this course is to provide students with theoretical knowledge and practical skills required in physical chemistry, especially thermodynamics. During the lectures students are acquainted with theory behind such processes as reversibility, phase change equilibrium and chemical reaction equilibrium. Practical lessons contribute to the understanding of thermodynamic potential and entropy change using mathematical methods. Work in laboratory allows students to acquire the simplest experiment conduction technique. By completing tasks given, both practical and theoretical skills of the student experience a noticeable rise. Throughout the development of laboratory work, scholars obtain immensely needed documentation expertise, methods of data processing, whilst also training to interpret and evaluate received results.

Results:
Upon successful completion of this course, students understand the basic laws of thermodynamics and are able to use them to calculate the most important thermodynamic characteristics of chemical processes. The student understands the interphase balance and chemical equilibrium and is able to solve the related problems. The student has mastered the basic experimental skills of physical chemistry and is able to evaluate the experiment and analyze the results of the practical measurements.

Contents of the course:
Sub-branches of physical chemistry, basic concepts of chemical thermodynamics. Status and process functions. The first law of thermodynamics. Principle of temperature and entropy. Coordinate transformations. Thermodynamic potential. Maximum work. The second law of thermodynamics. Entropy and calculation of its change. Gibss free energy. Phase balance. Chemical equilibrium conditions.

Thermodynamics of liquid and solid solutions. Current physical chemistry problems and modern research methods.

Plan of the course:

(shows the content, structure and calendar of the course)
Structure of the course: lectures - 32 h, laboratory works – 32 h

Lecture themes:

1. Basic concepts of physical chemistry and chemical thermodynamics.
2. State and path functions.
3. First law of thermodynamics. Heat of the process as a state function.
4. Hess's law and Kirchhoff's law.
5. Simple processes. Adiabatic process.
6. Carnot cycle. $\Sigma Q/T$ as a state function. $\Sigma \delta i\ Q/Ti$ arbitrary process.
7. Complete differentials and conversion of the state function δQ to the complete differential.
8. Temperature and entropy principle. Conversion of coordinates.
9. Scaling problem in pV – TS conversions. Thermodynamic potential.
10. Maximal work. Second law of thermodynamics.
11. Entropy and calculation of its change. Change in Gibbs energy.
12. Phase equilibrium. Clapeyron-Clausius equation. Shreder-Le Chatelier equation.
13. Gas mixture Gibbs potential. Conditions of chemical equilibrium.
14. Thermodynamics of solids and liquids. Chemical equilibrium in solutions.
15. Transfer processes.
16. Topical problems of physical chemistry and modern research methods.

Laboratory works:

1. Determination of vapor molecular weight;
2. Determination of liquid density;
3. Cryoscopic Determination of Molecular Weight;
4. Cryoscopic determination of dissociation constant;
5. Determination of dissolution heat;
6. Experimental determination of ionic mobility;
7. Electrolytic determination of ion transfer numbers;
8. Determination of specific electrical conductivity by DC;
9. Determination of the degree of dissociation of weak electrolyte;
10. Conductometric titration;
11. High frequency titration;
12. Electromotive force and its measurement;
13. Relative electrode potential and measurement of it;
14. Use of the first type of electrodes;
15. Thermodynamics of the galvanic cell
16. Use of the second type of electrodes;

Requirements for obtaining credit points:

Successful participation in laboratory work 30%, 20% tests during the course; 50% exam at the end of the course.

Reference literature, study materials:

1. Atkins P., Paula J. Atkins'Physical chemistry. 8th edition. Oxford, Uni-Press, 2006, 1064 p.
2. Th.Engel, Ph.Reid. Physical Chemistry. Pearson, 2006., 1062 p.
3. Atkins P.W. Physikalische Chemie.-Weinheim: VCH, 1987.
4. Balodis J. Praktiskie darbi fizikālajā ķīmijā. I,II un III daļa. Zvaigzne, 1972, 1975, 1978.
5. Gerasimovs J. Fizikālā ķīmija. I daļa, Rīga, Zvaigzne, 1972, 595 lpp.

Additional literature:

1.Schwenz R.W., Moore R.J. Physical Chemistry.- Washington: American Chemical Society, 1993.
2.Alksnis U. u.c. Fizikālā un koloidālā ķīmija.- R.: Zvaigzne, 1990.

Recommended periodical literature

1. J. Chem. Education
2. www.scirus.com

Notes:

What study programs and their parts (A, B, C, D) are relevant to this course:

ABSP „Chemistry”, part A

Name of the course in English:

Physical and Colloidal Chemistry I

Abstract of the course in English:

The aim of the course is to equip students with the theory of physical chemistry including reversibility of thermodynamic processes, phase equilibrum, and balance of chemical processes. Students will have obtained basic skills in physical chemistry.