



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Chemical and Process Thermodynamics

### Course

Field of study

Year/Semester

Chemical Technology

II/3

Area of study (specialization)

Profile of study

-

general academic

Level of study

Course offered in

First-cycle studies

English

Form of study

Requirements

full-time

compulsory

### Number

#### of hours

Lecture

Laboratory classes

Other (e.g. online)

0

0

0

Tutorials

Projects/seminars

30

0

#### Number of credit points

2

### Lecturers

Responsible for the course/lecturer:

Responsible for the course/lecturer:

Prof. Andrzej Lewandowski

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### Prerequisites

Students:

have knowledge in general chemistry (writing chemical reactions, converting concentrations, knowledge of laboratory glassware and basic laboratory equipment).

have knowledge in mathematics and physics enabling the introduction of problems in physical chemistry (basic laws of physics, differential calculus).

are able to prepare solutions of specific concentrations.



are aware of further development of their competences.

### **Course objective**

To familiarise students with basic problems in physical chemistry at the academic level in the field of: thermodynamic functions (the first and second laws of thermodynamics, the Gibbs free energy, thermochemistry, the thermodynamic equation of state), phase equilibrium – one-component and multi-component systems, surface and chemical equilibrium, colloidal systems and energy sources.

### **Course-related learning outcomes**

#### Knowledge

Students will be able to formulate and explain the basic theories of surface phenomena, heat engines and energy sources. K\_W03, K\_W10

Students will be able to define the basic concepts and laws of thermodynamics, determine the basic limitations and scope of their applicability; describe phenomena and processes in thermodynamics. K\_W03, K\_W10

#### Skills

Students will be able to obtain information from literature, databases and other sources; interpret it as well as draw conclusions and formulate and substantiate opinions. K\_U01

Students will be able to plan and carry out measurements of basic physicochemical parameters. K\_U22, K\_U23

Students will be able to apply the principles of thermodynamics in the implementation of chemical processes. K\_U23

Students will have the self-study skills in the subject. K\_U05

Students will be able to elaborate, describe and present results of an experiment or theoretical calculations. K\_U09

#### Social competences

Students will be aware of the responsibility for jointly performed tasks. They will be able to work as a team. K\_K03

Students will understand the need for further training and developing their professional competences. K\_K01

### **Methods for verifying learning outcomes and assessment criteria**

Learning outcomes presented above are verified as follows:



Exercises: grade on the basis of points obtained for activity during classes, writing tests. Passing exercises from 60% .

### Programme content

Exercises:

Physicochemical calculations in the field of:

Chemical thermodynamics

First law of thermodynamics. Heat balance of chemical reactions. Calculation of thermal effects based on table values. Heat capacity  $C_v$  and  $C_p$  and their dependence on temperature. Standardization of thermal effects of chemical reactions. Second law of thermodynamics. Determining the direction of chemical transformation. Entropy as a state function of direction. Thermodynamic potentials - calculating the constant equilibrium of chemical reactions. Determining the effect of temperature on equilibrium constant.

### Teaching methods

Exercises with discussion. Deductive method. The exercises involve solving partial tasks and solving detailed problems.

### Bibliography

Basic

1. P. Atkins, Physical Chemistry, Oxford University Press
2. RS. Barry, SA. Rice, J. Ross, Physical Chemistry, Wiley & Sons, New York 1980.

Additional

1. Physical Chemistry Instructions: <http://zchf.fct.put.poznan.pl>.
2. Thermodynamics Lab Instructions <http://moodle.put.poznan.pl>

### Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	35	1,4
Student's own work (literature studies, preparation for tests ) <sup>1</sup>	15	0,6

<sup>1</sup> delete or add other activities as appropriate