# STUDY MODULE DESCRIPTION FORM

| Name of the module/subject | Code |
|---|---|
| **Physical Chemistry II** | |

| Field of study | Profile of study (general academic, practical) | Year /Semester |
|---|---|---|
| **Chemical and Process Engineering** | **general academic** | **2 / 4** |
| Elective path/specialty | Subject offered in: **Polish** | Course (compulsory, elective) **compulsony** |

| Cycle of study: | Form of study (full-time,part-time) |
|---|---|
| **First-cycle studies** | **full-time** |

| No. of hours | No. of credits |
|---|---|
| Lecture: **15** Classes: **-** Laboratory: **45** Project/seminars: **-** | **5** |

| Status of the course in the study program (Basic, major, other) | (university-wide, from another field) |
|---|---|
| **basic** | **university-wide** |

| Education areas and fields of science and art | ECTS distribution (number and %) |
|---|---|
| | **2.5 100%**<br>**2.5 100%** |

## Responsible for subject / lecturer:

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## Prerequisites in terms of knowledge, skills and social competencies:

| | | |
|---|---|---|
| 1 | **Knowledge** | W1 have a basic knowledge of general chemistry (writing chemical reactions, conversion levels, knowledge of basic laboratory glassware and laboratory equipment)<br>W2 have a basic knowledge of mathematics and physics necessary to understand issues of physical chemistry (fundamental laws of physics, the camera differential) |
| 2 | **Skills** | **U1 -** able to prepare solutions of the concentrations, can handle the weight<br>U2 able to apply known mathematical apparatus for calculation of physicochemical |
| 3 | **Social competencies** | K1 - Understands the need and knows the possibilities of lifelong learning |

## Assumptions and objectives of the course:

To acquaint the student with basic issues of physical chemistry at university level in the field: chemical kinetics, reaction of simple and complex, catalysis of homo-and heterogeneous

## Study outcomes and reference to the educational results for a field of study

### Knowledge:

1.Able to define and explain the basic concepts and ideas in the field of chemical kinetics, such as the rate of the reaction, rate law and rate constans, half-lives ant time constans, activation energy, activated complex theory, Arrhenius equation, transition state theory, Eyring equation [K_W03, K_W10]
2. Able to characterize, replace and recognize elementary and complex reactions, able to define homo-and heterogeneous catalysis, give examples and practical application [K_W03, K_W10]

### Skills:

1. Is able to obtain information from the literature, internet, databases and other sources. Can integrate the information to interpret and learn from them, create and justify opinions [K_U01]
2. Is able to plan and carry out simple experiment [K_U07, K_U08]
3. Has the ability to self-educate using modern teaching tools such as remote lectures, webpages and databases, educational software, electronic books[K_U05]
**4.** Able to develop, describe and present the results of an experiment or theoretical calculation[K_U07, K_U08]

### Social competencies:

Has a sense of responsibility for one's own work and is willing to comply with the principles of teamwork and taking responsibility for collaborative tasks.[ K_K04]

## Assessment methods of study outcomes

Current control during laboratory classes. Lectures completed a written exam. Students are classified on the basis of laboratory generated points from the plan and perform the experiment, the implementation of the report.

dst 70-85 points
dst+ 86-90
db 91-100
db+ 101-110
bdb 111-120

## Course description

Chemical kinetics: the rates of reactions, rate law and rate constants, first order reactions, half-lives and time constants, second-order reactions, the temperature dependence of reaction rates (Arrhenius equation)
The reaction product is formed directly from the activated complex:
The concept of an active complex. , the temperature dependence of reaction rates - Arrhenius equation - Eyring equation. Enthalpy and entropy of activation. The relationship between the parameters of the Arrhenius equation and Eyring'a. Two barriers to the reaction: energy and structural (energy and entropy of activation). Pressure effect on the rate of reaction gas. The kinetic analysis of complex reaction: consecutive reactions, parallel reactions, competing reactions, chain reactions, reversible reactions .
Homogeneous catalysis: The types of homogeneous catalysts in a solution liquid state. Catalyzed reaction rate dependence on the amount of catalyst. Enzymes. Heterogeneous catalysis: The principle of operation of solid heterogeneous catalysts. The carrier of the catalyst. Examples of different mechanisms of catalysis on contact. The rate of diffusion limited process..
Explosive reactions: power of explosion, he detonation, deflagration

**Basic bibliography:**

1. K. Pigoń, Z. Ruziewicz, Chemia Fizyczna, PWN Warszawa 2005.
2. P. Atkins, ChemiaFizyczna, PWN, Warszawa 2001.
3. J. Sobkowski, Chemia jądrowa, PAN, Warszawa 1981.
4. St. Magas, Technika Izotopowa, WPP 1994 (skrypt nr.1794).
5. A. Molski, Wprowadzenie do kinetyki chemicznej WNT warszawa 2000.
6. L. Sobczyk , Eksperymentalna Chemia Fizyczna, PWN Warszawa 1982

**Additional bibliography:**

1. P. Atkins, Podstawy Chemii Fizycznej, PWN, Warszawa 1999
2. L. Sobczyk, A. Kisza, Chemia fizyczna dla przyrodników PWN Warszawa 1977
3. J. Minczewski, Chemia analityczna, PWN Warszawa 1975.
4. H. Buchnowski, W .Ufnalski Wykłady z chemii fizycznej WNT Warszawa 1998
5. A. Lewandowski, St. Magas, Wiadomości do ćwiczeń laboratoryjnych z chemii fizycznej, WPP, Poznań 1994 (skrypt nr 1765).

Instrukcje do ćwiczeń laboratoryjnych z chemii fizycznej.

## Result of average student's workload

| Activity | Time (working hours) |
|---|---|
| Exam | **12** |
| Preparation for laboratory | **36** |

## Student's workload

| Source of workload | hours | ECTS |
|---|---|---|
| Total workload | 120 | 5 |
| Contact hours | 65 | 2 |
| Practical activities | 92 | 3 |