# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fundamentals of Chemical Engineering

## Course

Field of study
Pharmaceutical Engineering
Area of study (specialization)
-
Level of study
First-cycle studies
Form of study
full-time

Year/Semester
3/5
Profile of study
general academic
Course offered in
polish
Requirements
compulsory

## Number of hours

Lecture
15
Laboratory classes
Other (e.g. online)
0
Tutorials
0
Projects/seminars
15

## Number of credit points

2

## Lecturers

Responsible for the course/lecturer:
dr hab. inż. Grzegorz Musielak, prof. PP

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Wydział Technologii Chemicznej

ul. Berdychowo 4, 61-131 Poznań

Responsible for the course/lecturer:

## Prerequisites

The student should have knowledge of mathematics in the field of differential and integral calculus (K_W2).

The student should have knowledge of physics, in particular mechanics and thermodynamics, in the basic range (K_W3).

The student should have knowledge and skills in the subject of Fundamentals of Chemical Engineering, first semester (K_W10, K_W12, K_U13-17)

The student should be able to use specialist literature and draw conclusions on its basis (K_U1).

The student should be able to implement self-education (K_U24).

The student should understand the need for further training and raising their professional competences (K_K1).

## Course objective

Mastering knowledge in the field of heat and mass transport. Use this knowledge to formulate and solve heat transfer and mass transfer problems.

## Course-related learning outcomes

### Knowledge

1. knowledge of heat transfer equation, diffusion equation, and solutions of these equations [K_W10]

2. knowledge of similarity theory and dimensional analysis in the field of heat and mass transport [K_W10]

3. knowledge of heat transport during boiling and condensation [K_W10]

4. knowledge of moist air thermodynamics [K_W10]

5. knowledge of filtration issues [K_W10]

### Skills

1. ability to solve the heat conduction equation and diffusion equation [K_U14, K_U15]

2. ability to calculate and design heat and mass exchangers [K_U13, K_U17]

3. ability to use specialist literature on chemical and process engineering [KU_1]

4. self-education skill [K_U24]

### Social competences

1. understands the need for self-education and raising their professional competences [K_K1]

2. is aware of compliance with ethical principles in the broad sense [K_K3, K_K8]

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Completing project exercises based on the assessment of the ability to solve project tasks.

Completing lectures in the form of a written exam about mastering and understanding the whole material.

## Programme content

The course presents heat and mass transport processes in the field related to pharmaceutical engineering. In particular, the following are discussed:

two-dimensional heat conduction;

transient problems of heat transport (convective heating of the plate, heat conduction with a small Biot number)

similarity theory and dimensional analysis for heat transport in liquid (dimensionless numbers, correlation equations);

heat transfer by boiling and condensation;

heat exchangers.

As part of mass transport, the following are discussed:

parameters characterizing the mixture;

mass balance equation for a mixture (equation, mass flow definitions, average speed, barycentric speed);

mass transport mechanisms (diffusion, diffusion coefficients, mass convection);

diffusion equation (general form, special forms, solution conditions);

established diffusion issues (diffusion chamber, equilibrium mutual diffusion);

transient diffusion issues (diffusion in half space);

similarity theory and dimensional analysis for mass transport;

moist air thermodynamics and drying theory;

filtration (Darcy's law and filter equation).

## Teaching methods

lecture and computational design exercises

## Bibliography

Basic

1. Z. Kembłowski, S. Michałowski, Cz. Strumiłło, R. Zarzycki, Podstawy teoretyczne inżynierii chemicznej i procesowej, Warszawa, PWN 1985.

2. Malczewski J., Piekarski M., Modele procesów transportu masy, pędu i energii, Warszawa, PWN 1992.

3. Zadania projektowe z inżynierii procesowej, Biń A., Huettner M., Kopeć J., Kozłowski M., Nowosielski J., Sieniutycz S., Szembek-Stoeger M., Szwast Z., Wolny A., Wyd. Politechniki Warszawskiej 1986.

4. J. Ciborowski, Inżynieria procesowa, Warszawa, WNT 1973.

5. T. Hobler, Ruch ciepła i wymienniki, wyd. 4, Warszawa, PWN 1971.

6. S. Wiśniewski, T. Wiśniewski, Wymiana ciepła, WNT Warszawa 2000, Wyd. V.

Additional

1. S.J. Kowalski, Teoria procesów przepływowych cieplnych i dyfuzyjnych, Wydawnictwo Politechniki Poznańskiej, Wyd. 1999 oraz 2008;

2. K. Brodowicz, Teoria wymienników ciepła i masy, PWN-Warszawa, 1982;

**Breakdown** of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 65 | 2,0 |
| Classes requiring direct contact with the teacher | 45 | 1,4 |
| Student's own work (literature studies, preparation for tests/exam, project preparation) [1] | 20 | 0,6 |

[1] delete or add other activities as appropriate