POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fundamentals of chemical engineering [S1IFar2>PIC2]

Course

Field of study
Pharmaceutical Engineering

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
15

Number of credit points

3,00

Coordinators

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Lecturers

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.
The exam in the form of a test consists of 20 open questions. If it is necessary to perform the examination remotely, a test examination consisting of 20 closed questions is planned. The maximum number of points for completing the test is 20. The number of points obtained is rounded up to the integer value. In the case of the test, the final exam grade is determined on a linear scale: 0-10 points - 2.0; 11-12 points - 3.0; 13-14 points - 3.5; 15-16 points - 4.0; 17-18 points - 4.5; 19-20 points - 5.0.

Programme content

The course presents heat and mass transport processes in the field related to pharmaceutical engineering. In particular, the following are discussed:
- dimensionless differential equation of heat transport;
- ways to increase the intensity of heat exchange;
- 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);
- steady diffusion issues (equimolar and non-equimolar mutual diffusion, diffusion through an inert factor, diffusion chamber);
- transient diffusion issues (diffusion in half space);
- similarity theory and dimensional analysis for mass transport;
- filtration (Darcy's law).

Course topics

none

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	75	3,00
Classes requiring direct contact with the teacher	38	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	37	1,50