COURSE DESCRIPTION CARD - SYLLABUS

Course name
Heat and mass transfer processes [S1IFar2>PWCiM]

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
elective

Number of hours

Lecture
0

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

1,00

Coordinators

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Lecturers

Prerequisites

The student has ordered knowledge of mathematics, physics and chemistry acquired in classes at the first degree of study, enabling understanding of physical and chemical phenomena in the field of momentum, heat and mass exchange processes. Is able to acquire and supplement knowledge on chemistry, physics and mathematics from academic textbooks, other books and databases, has the ability to self-study, is able to work individually and in a team, plan and conduct experiments, interpret the results obtained and draw conclusions, is able to apply the principles of health and safety related to with work done. Understands the need for continuous training and setting ambitious goals on the way to achieving higher education, is aware of the responsibility for tasks carried out in teamwork.

Course objective

Understanding the basic industrial processes and unit operations related to chemical and process engineering on a laboratory scale. Developing skills to analyze and interpret observation results and experiments for heat and mass transfer issues.

Course-related learning outcomes

Knowledge:

1. Student has solid knowledge in the field of basic processes: mass, energy and momentum exchange. [K_W10]
2. Student knows the basics of kinetics, thermodynamics of chemical processes. [K_W11]
3. Student has knowledge of fluid mechanics, hydraulics and flow dynamics, as well as technical rheology in the field appropriate for pharmaceutical engineering. [K_W12]

Skills:
1. Student is able to plan and conduct simple experiments in the field of pharmaceutical engineering, both experimental and simulation, as well as interpret their results and draw conclusions. [K_U12]
2. Student observes the health and safety rules when working in the laboratory. [K_U22]
3. Student has self-study skills. [K_U24]

Social competences:
1. Student understands the need for self-education and raising their professional competences. [K_K1]
2. Student is aware of compliance with ethical principles in the broad sense. [K_K4, K_K8]
3. Student can work in a team. [K_K2]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Completion of the laboratory based on knowledge (oral/written answer carried out in stationary or on-line mode, depending on the method of conducting classes), teamwork during exercises, the ability to perform simple measurements, develop the results of experiments and the ability to draw conclusions from experiments.

Programme content

The program covers the following topics:
1. Heat exchanger.
2. Determination of heat conduction coefficient in a nonstationary process.
3. Determination of air humidity by psychrometric method.
4. Convection and microwave drying - comparison and assessment of process efficiency.
5. Filtration through a porous bed.

Course topics

The cycle of laboratory classes includes five exercises in the field of heat and mass exchange processes:
1. Heat exchanger.
2. Determination of heat conduction coefficient in a nonstationary process.
3. Determination of air humidity by psychrometric method.
4. Convection and microwave drying - comparison and assessment of process efficiency.
5. Filtration through a porous bed.

Teaching methods

Performing practical exercises in accordance with the course plan and presenting a written report.

Bibliography

Basic:
1. J. Bukowski, Mechanika płynów, PWN Warszawa, 1970, wyd. 3
2. J. Ciborowski, Inżynieria procesowa, Warszawa, WNT 1973
3. T. Hobler, Ruch ciepła i wymienniki, wyd. 4, Warszawa, PWN 1971

Additional:
1. J.E. Elsner, Turbulencja przepływów, PWN Warszawa 1987
2. Podstawowe procesy inżynierii chemicznej. Przenoszenie pędu, ciepła i masy, praca zbiorowa pod red. Z. Ziołkowskiego, PWN Warszawa 1982

Breakdown of average student's workload

	Hours	ECTS
Total workload	30	1,00
Classes requiring direct contact with the teacher	15	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	15	0,50