COURSE DESCRIPTION CARD - SYLLABUS

Course name

Process kinetics

Course

Field of study

Chemical and process engineering

Year/Semester

3/6

Area of study (specialization)

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

30

Laboratory classes

45

Other (e.g. online)

Tutorials

Projects/seminars

15

Number of credit points

5

Lecturers

Responsible for the course/lecturer:

dr hab. inż. Jacek Różański

e-mail: Jacek.Rozanski@put.poznan.pl

tel. 61 665 2147

Responsible for the course/lecturer:

Prerequisites

Students starting this subject should have basic knowledge in mathematics, physics, chemistry, statistics, engineering graphics, fluid mechanics and materials technology. They should also have the ability to use spreadsheets, performing statistical analysis of measurement results and be ready to work in a team.

Course objective

Obtaining knowledge in the field of kinetics of heat and mass transfer processes.

Development of skills of perform process calculations of heat and mass transfer exchangers.

Course-related learning outcomes

Knowledge

1. Student knows the fundamentals of kinetics of heat and mass transfer – [K_W10]

2. Student has a well-organized general and specific knowledge in the field of chemical engineering – [K_W13]

3. Student knows basic methods, techniques and tools used to solve simple engineering tasks related to chemical engineering – [K_W15]

Skills

1. Student can acquire information from literature, databases and other sources related to chemical and process engineering, also in a foreign language, integrate them, interpret, draw conclusions and formulate opinions - [K_U01]

2. Student can plan and conduct simple experiments in chemical and process engineering, interpret their results and draw conclusions - [K_U08]

3. Student can identify basic heat and mass processes and formulate their specifications - [K_U17]

4. Student can design heat and mass transfer operations and choose the appropriate equipment for solving simple engineering tasks - - [K_U19] [K_U21]

Social competences

1. Student is aware of the responsibility for her/his own work and the willingness to subordinate teamwork and take responsibility for jointly accomplished tasks – [K_K04]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge acquired during the lecture is verified during the exam. The exam consists of 5 open questions for the same number of points. Minimum threshold: 50% points Exam issues, on the basis of which questions are formed, will be sent to students by e-mail using the university e-mail system.

Skills and knowledge acquired as part of the laboratory work are verified on a daily basis based on oral answers and 2 final tests, consisting of 4-6 questions for the same number of points

Skills and knowledge acquired during project classes are verified on the basis of the heat exchanger project and test, consisting of 3-4 tasks. Minimum threshold: 50% points

Programme content

Course covers the following topics:

1. Mechanisms of heat transfer

2. Thermal conduction

3. Overall heat transfer coefficient

4. Thermal insulation, calculation of heat loss, critical thickness of insulation

5. Forced convection in heat transfer

6. Falling film on a vertical flat plate

7. Heat transfer in a falling film

8. Heat transfer during condensation of steam

9. Natural convection in heat transfer

10. Mixed-convection in heat transfer

11. Heat transfer in boiling

12. Mass transfer mechanisms

13. Equilibrium between gas and liquid phases

14. Diffusion in the gaseous phase (diffusion of one component through an inert multi-component mixture, equimolar counterdiffusion)

15. Diffusion in the liquid phase

16. Mass transfer in forced turbulent flow (flow in pipe, flow through a packed bed)

17. Mass transfer in falling liquid films on a vertical flat plate

18. Mass transfer in the downward liquid flow through packing

19. Mass transfer between phases

20. Absorption accompanied by chemical reaction

21. Plate efficiency

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples on the board.

2. Laboratory exercises: performing experiments related to heat, mass and momentum transfer processes.

3. Project: multimedia presentation, illustrated with tasks solved on the board.

Bibliography

Basic

1. Zarzycki R.: Wymiana ciepła i ruch masy w inżynierii środowiska, WNT, Warszawa 2005.

2. Wiśniewski S., Wiśniewski T.S., Wymiana ciepła, WNT, Warszawa 2012.

3. Hobler T.: Dyfuzyjny ruch masy i absorbery, WNT, Warszawa 1976.

4. Hobler T.: Ruch ciepła i wymienniki, WNT, Warszawa 1986.

5. Koch R., Kozioł A., Dyfuzyjno-cieplny rozdział substancji, WNT, Warszawa 1994.

6. Broniarz-Press L. i inni: Inżynieria chemiczna i procesowa. Laboratorium, Wydawnictwo Politechniki Poznańskiej, Poznań 2000.

7. Palica M., Gierczycki A., Lemanowicz M., Operacje inżynierii chemicznej, część 1 i 2, Wydawnictwo Politechniki Śląskiej, Gliwice 2013.

8. Broniarz-Press L. i inni: Inżynieria Chemiczna i Procesowa. Materiały Pomocnicze. Części II-III. Wydawnictwo Politechniki Poznańskiej, Poznań 1999-2005.

9. Oleśkowicz-Popiel C., Wojtkowiak J.: Eksperymenty w wymianie ciepła, Politechniki Poznańskiej, Poznań 2004.

10. Troniewski L.: Hoblerowskie ujęcie ruchu masy, Wydawnictwo WSI, Opole 1996.

Additional

1. Broniarz-Press L.: Hydrodynamika spływu filmowego cieczy i zjawiska przenoszenia w aparatach warstewkowych, Wydawnictwo Politechniki Poznańskiej, Poznań 2004.

2. Coulson J.M., Richardson J.F.: Chemical Engineering, vol. I-VI, Butterworth Heinemann, Oxford 1999-2002.

3. Danckwerts P.V.: Gas-Liquid Reactions, McGraw Hill Book Comp., New York 1970.

4. Plawsky J.L.: Transport Phenomena Fundamentals, Dekker, New York 2001.

5. Pohorecki R., Wroński S.: Termodynamika i kinetyka procesów inżynierii chemicznej, WNT, Warszawa 1977.

6. Bandrowski J., Gierczycki A., Thullie J.: Przykłady i zadania z dyfuzyjnego transportu masy, Wydawnictwo Politechniki Śląskiej, Gliwice 2001.

7. Biń A. i inni: Zadania projektowe z inżynierii procesowej, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2002.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,0
Classes requiring direct contact with the teacher	90	3,6
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	35	1,4

[1] delete or add other activities as appropriate