COURSE DESCRIPTION CARD - SYLLABUS

Course name

Inżynieria chemiczna (Chemical Engineering)

Course

Field of study

Technologia chemiczna (Chemical Technology)

Year/Semester

III/5

Area of study (specialization)

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

Polish

Form of study

part-time

Requirements

compulsory

Number of hours

Lecture

30

Laboratory classes

Other (e.g. online)

Tutorials

Projects/seminars

10

Number of credit points

5

Lecturers

Responsible for the course/lecturer:

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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, 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

The aim of the course is to give the student knowledge of the heat, mass and momentum transfer theories and the ability to perform process calculations.

Course-related learning outcomes

Knowledge

1. Student has a basic knowledge of technical rheology [K_W11]

2. Student knows the basics of single and two-phase flow fluid dynamics [K_W10], [K_W13]

3. Student knows the basics of the heat and mass transfer theory [K_W13]

4. Student knows the theoretical basis of sedimentation, filtration, absorption, distillation and rectification [K_W13]

Skills

1. Student has the skills to perform of the process calculations associated with the heat transfer and fluid transport K_U08

2. Student has the skills to perform designs of equipment in which heat and momentum transfers occur K_U15

3. Student on the basis of acquired general knowledge has skills to explain of physical phenomena occurring in chemical installations K_U16

4. Student has can choose unit operation to solve a specific of technological problem K_U12

Social competences

1. Student has the awareness and understanding of aspects of the practical application of knowledge and the effects of engineering activities K_K01

2. Student is able to interact and work in a group K_K02

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 test. The test consists of about 30 closed questions. Minimum threshold: 50% points. The 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 during project classes are verified on the basis of the heat exchanger project.

Programme content

Course covers the following topics:

1. Shear flow of a Newtonian fluid

2. Characterization of non-Newtonian fluids

3. Flow of fluids in a pipe (laminar and turbulent flows, velocity distributions for laminar and turbulent flows, pressure drop for flow of Newtonian liquids through a pipe).

4. The continuity equation

5. General energy balance

6. Falling liquid films

7. Flow of fluids through porous beds

8. Motion of particles in a fluid

9. Sedimentation

10. Filtration

11. Heat transfer (mechanisms of heat transfer, thermal conduction, heat transfer by convection, forced convection in tubes, natural convection, condensation of vapors, boiling liquids)

12. Mass transfer (phase equilibrium, diffusion in binary gas mixtures, diffusion in liquids, convective mass transfer, mass transfer coefficient, overall transfer coefficients, absorption, distillation, rectification)

Teaching methods

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

2. 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. Bandrowski J., Troniewski L.: Destylacja i rektyfikacja, Wyd. Politechniki Śląskiej, Gliwice 1996.

10. Koch R., Noworyta A.: Procesy mechaniczne w inżynierii chemicznej, WNT, Warszawa 1995.

11. Orzechowski Z., Prywer J., Zarzycki R.: Mechanika płynów w inżynierii środowiska, WNT, Warszawa 1997

Additional

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

2. Sinnott R.K. Towler G.: Chemical Engineering Design, 5th Edition, Elsevier, 2009.

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

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

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

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,0
Classes requiring direct contact with the teacher	50	2,0
Student's own work (literature studies, preparation for project classes, preparation for test) [1]	75	3,0

[1] delete or add other activities as appropriate