COURSE DESCRIPTION CARD - SYLLABUS

Course name
Chemical engineering [S1TCh2>IC]

Course

Field of study
Chemical Technology

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
30

Laboratory classes
60

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

7,00

Coordinators

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Lecturers

Prerequisites

Students starting this subject should have basic knowledge in mathematics, physics, chemistry, statistics, engineering graphics, physical chemistry, thermodynamics, 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 provide knowledge of the heat, mass and momentum transfer theories and the ability to perform model studies.

Course-related learning outcomes

Knowledge:
1. Student knows the basic concepts of chemical engineering dynamics of one- and two-phase flow of fluids. [K_W10], [K_W13]
2. Student knows basics of heat and mass transfer theories [K_W13]
3. Student knows the theoretical basis of filtration, absorption, distillation and rectification. [K_W13]

Skills:
1. Student can assess the suitability of experimental methods for solving engineering tasks - [K_U14]
2. Student can to perform process calculations related to momentum, heat and mass transfers - [K_U08]
3. Student can to design equipments where momentum, heat and mass transfer take place - [K_U15]
4. Based on general knowledge student can explain basic phenomena related to important processes in chemical engineering - [K_U16]
5. Student can choose a unit operation suitable for a specific technological problem - [K_U12]

Social competences:
1. The student can cooperate and work in a team [K_K03]

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 (5 points). The grade will be issued according to a scale: up to 12.5 - unsatisfactory; from 13.0 to 14.5 - sufficient; from 15.0 to 17.0 - a sufficient plus; from 17.5 to 19.5 - good; from 20.0 to 22.0 - a good plus; from 22.5 - very good. Exam issues, on the basis of which questions are formed, will be sent to students by e-mail using the university e-mail system. The online exam will be conducted on the same terms via the eMeeting platform or another platform recommended by the Poznań University of Technology.
Skills and knowledge acquired as part of the laboratory are verified on a daily basis based on oral answers and 2 final tests, consisting of 3 open questions for the same number of points (5 points). To pass the laboratory you must:
1. Provide an oral answer from the material contained in the exercises and from the given issues (each failing grade must be corrected to a positive).
2. Perform all laboratory exercises provided in the study program
3. Get passes for reports on the exercises performed.
4. Pass two tests: three open-ended questions for the same number of points (5 points) (grading scale: up to 7.5 - unsatisfactory; from 8.0 to 9.0 - sufficient; from 9.5 to 10.5 - a sufficient plus; from 11.0 to 12.0 - good; from 12.5 to 13.5 - a good plus; from 14.0 - very good.).
5. The final grade will be issued on the basis of:
a) the arithmetic mean of all grades obtained from oral responses,
b) the arithmetic mean of all the grades obtained in the tests.
The arithmetic means calculated in this way will be divided by two and the final grade will be issued according to a scale: up to 2.74 - unsatisfactory; from 2.75 to 3.24 - sufficient; from 3.25 to 3.74 - a sufficient plus; from 3.75 to 4.24 - good; from 4.25 to 4.74 - a good plus; from 4.75 - very good.
Passing the laboratory will be in an online form, carried out on the same terms via the eMeeting platform or another platform recommended by the Poznań University of Technology.

Programme content

Course covers the following topics:
1. Shear flow of the Newtonian fluid
2. 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).
3. The continuity equation
4. General energy balance
5. Falling liquid films
6. Flow of fluids through porous beds
7. Filtration
8. Heat transfer (mechanisms of heat transfer, thermal conduction, heat transfer by convection, forced convection in tubes, natural convection, condensation of vapours, boiling liquids)
9. Mass transfer (phase equilibrium, diffusion in the gaseous phase, diffusion in the liquid phase, convective mass transfer, mass transfer coefficient, overall mass transfer coefficients, absorption, distillation, rectification)

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.

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.
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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	175	7,00
Classes requiring direct contact with the teacher	94	4,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	81	3,00