



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Separation of Mixtures - Membrane Treatment of Pharmaceuticals and Waste Streams

### Course

Field of study

Pharmaceutical Engineering

Area of study (specialization)

-

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

4/7

Profile of study

general academic

Course offered in

polish

Requirements

elective

### Number of hours

Lecture

0

Tutorials

0

Laboratory classes

15

Projects/seminars

0

Other (e.g. online)

0

### Number of credit points

1

### Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

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### Prerequisites

Elementary knowledge in the field of general, inorganic, organic and physical chemistry as well as familiarity with the equipment of pharmaceutical industry; awareness of main environmental hazards resulting from industrial activity.

### Course objective

The aim of course is to gain the knowledge and practical skills in membrane separation techniques used in pharmaceutical industry. Laboratory exercises are based on active practical learning of membrane filtration techniques in terms of separation of pharmaceuticals and sewage treatment in pharmaceutical industry.

### Course-related learning outcomes

#### Knowledge

\*K\_W8 knows the principles of environmental protection related to pharmaceutical technology and waste management; has necessary knowledge on hazards related to implementation of chemical and pharmaceutical processes (P6S\_WG P6S\_WK)

\*K\_W15 has detailed knowledge in separation processes and treatment of raw materials and products used in pharmaceutical, cosmetic and chemical industry (P6S\_WG P6SI\_WG)

\* K\_W18 has basic knowledge in terms of construction of equipment and installations in pharmaceutical industry and in related industries (P6S\_WG P6SI\_WG)

#### Skills

\* K\_U15 is able to identify basic unit processes and operations of pharmaceutical engineering and formulate their specifications (P6SI\_UW)

\* K\_U16 is able to select the proper approach and equipment to solve elementary and complex engineering problems related to pharmaceutical engineering; is able to analyze and evaluate the functioning of basic equipment of pharmaceutical industry (P6S\_UW P6SI\_UW)

#### Social competences

\*K\_K2 is ready to: take the individual decisions and lead the team, to critically evaluate his or her own activity and activity of the team, to take the responsibility for the effects of those activities; he or she is able to collaborate and work in group, inspire and integrate the people in his or her professional work environment (P6S\_KK)



\* K\_K3 is aware of importance of understanding the non-technical aspects and consequences of engineering activity including its impact on the natural environment and the responsibility related to the decisions made in this area; he or she identifies properly the problems and take the right choices related to the professional activity according to the professional ethical rules and care about the output and traditions related to the profession (P6S\_KR)

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The writing assignment before each laboratory exercise composed of 3 questions and graded in the range: 0-10 pkt. The following grading scale will be used:

3,0: 5,5-6,5 pts,

3,5: 6,5-7,0 pts,

4,0: 7,5-8,0 pts,

4,5: 8,5-9,0 pts,

5,0: 9,5-10 pts,

in addition to correct reports from each laboratory exercise made in team and given to the teacher.

### Programme content

The content of the course includes pressure- and current-driven membrane techniques used in pharmaceutical industry for separation of pharmaceuticals and for treatment of sewage formed along with industrial production. The students are being familiar with practical work of installations for reverse osmosis, forward osmosis, biomembrane reactors, ultrafiltration, classic and bipolar electrodialysis for treatment of waste streams. Moreover, the laboratory exercises include technical aspects of membrane processes, e.g. study on mass transport resistances in membrane separation or the work of different membrane modules

### Teaching methods

The students plan the experiment, make the measurements, calculation, graphically present and discuss the results, formulate the conclusions and write the report. The students participate in these activities in teams.

### Bibliography

Basic

1. M. Bodzek, J. Bohdziewicz, K. Konieczny, Techniki membranowe w ochronie środowiska, Wydawnictwo Politechniki Śląskiej, Gliwice, 1997.



2. K. Prochaska (Red.) Membranowe techniki separacji, Skrypt, Wydawnictwo Politechniki Poznańskiej, Poznań, 2013
3. J. Rautenbach, Procesy membranowe, WNT, Warszawa 1996
4. Biernacka, T. Suchecka, Techniki membranowe w ochronie środowiska, Wyd. SGGW, Warszawa 2004

Additional

1. S. Judd, C. Judd (Red.) The MBR Book. Principles and applications of membrane bioreactors for water and wastewater treatment, 2nd ed., Elsevier, 2011
2. Z. Zhang, W. Zhang, E. Lichtfouse, Membranes for Environmental Applications, Springer, 2020
3. K. Scott, Handbook of industrial membranes, Elsevier Advanced Technology, 1998

**Breakdown** of average student's workload

	Hours	ECTS
Total workload	30	1,0
Classes requiring direct contact with the teacher	20	0,7
Student's own work (literature studies, preparation for laboratory classes, preparation for tests, reports preparation) <sup>1</sup>	10	0,3

<sup>1</sup> delete or add other activities as appropriate