SYLLABUS
Fall semester 2023-2024 academic year
Educational program "6B07102 – Chemical Engineering"

ID and name of course	Independent work of the student (IWS)	Number of credits			General number of credits	Independent work of the student under the guidance of a teacher (IWST)
		Lectures (L)	Practical classes (PC)	Lab. classes (LC)		
89771 Separation Processes	4	15	-	60	5	5

ACADEMIC INFORMATION ABOUT THE COURSE

Learning Format	Cycle, component	Lecture types	Types of practical classes	Form and platform final control
Offline	CD. University component	Oral presentation	Lab	Written
Lecturer - (s)	Madi Abilev PhD, Associate professor			
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ACADEMIC COURSE PRESENTATION

Purpose of the course	Expected Learning Outcomes (LO) * As a result of studying the discipline the student will be able to:	Indicators of LO achievement (ID)
The purpose of the discipline is to develop the ability to perform mathematical description, selection of equipment and parameters for various chemical engineering processes related to the separation of substances.	1.explain the basic principles of the separation processes	1.1 The student can identify the separation process
		1.2 The student is able to explain the basic principles of classification
	2. choose the optimal parameters of the separation process	2.1 The student can choose the optimal separation process
		2.2 The student can substantiate the choice of the process
		2.3 The student knows how to optimize the parameters of the separation
	3. use the separation processes in the analysis of industrial objects	3.1 The student can use extraction methods
		3.2 The student can use sorption methods
		3.3 The student can use multistage separation
		3.4 The student can use membrane separation
	4. integrate the separation processes into the chemical engineering flowchart	4.1 The student knows main characteristics of the processes
		4.2 The student considers the separation as a part of the process flow chart
		4.3 The students can describe the main parts of the process
Prerequisites	Analytical chemistry, Chemical kinetics and electrochemistry	
Postrequisites	Process and plant design, Environmental engineering	
Learning Resources	**Literature:** 1. De Haan A.B., Bosch H. Industrial Separation Processes. Fundamentals. - Walter de Gruyter GmbH, 2013. - 385 p. 2. De Haan A.B., Eral H. Burak, Schuur Boelo. Industrial Separation Processes: Fundamentals. 2nd edition. — De Gruyter, 2020. — 457 p. 3. Khoury Fouad M. Multistage Separation Processes. 4th edition. — CRC Press, 2014. — 679 p.	

	4. Sridhar S., Moulik S. (eds.) Membrane Processes: Pervaporation, Vapor Permeation and Membrane Distillation for Industrial Scale Separations. - Wiley – Scrivener Publishing, 2019. — 491 p. **Research infrastructure** 1. Labs of the department of analytical, colloid chemistry and technology of rare elements **Professional scientific databases** 1. Web of Science 2. Scopus **Internet resources** 1. http://elibrary.kaznu.kz/ru 2. MOOC / video lectures. 3. https://www.twirpx.com/ 4. https://www.sciencedirect.com

Academic course policy	The academic policy of the course is determined by the Academic Policy and the Policy of Academic Integrity of Al-Farabi Kazakh National University . Documents are available on the main page of IS Univer. **Integration of science and education.** The research work of students, undergraduates and doctoral students is a deepening of the educational process. It is organized directly at the departments, laboratories, scientific and design departments of the university, in student scientific and technical associations. Independent work of students at all levels of education is aimed at developing research skills and competencies based on obtaining new knowledge using modern research and information technologies. A research university teacher integrates the results of scientific activities into the topics of lectures and seminars (practical) classes, laboratory classes and into the tasks of the IWST, IWS, which are reflected in the syllabus and are responsible for the relevance of the topics of training sessions and assignments. **Attendance.** The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course. Failure to meet deadlines results in loss of points. **Academic honesty.** Practical/laboratory classes, IWS develop the student's independence, critical thinking, and creativity. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of completing tasks are unacceptable. Compliance with academic honesty during the period of theoretical training and at exams, in addition to the main policies, is regulated by the "Rules for the final control" , "Instructions for the final control of the autumn / spring semester of the current academic year" , "Regulations on checking students' text documents for borrowings". Documents are available on the main page of IS Univer. **Basic principles of inclusive education.** The educational environment of the university is conceived as a safe place where there is always support and equal attitude from the teacher to all students and students to each other, regardless of gender, race / ethnicity, religious beliefs, socio-economic status, physical health of the student, etc. All people need the support and friendship of peers and fellow students. For all students, progress is more about what they can do than what they can't. Diversity enhances all aspects of life. All students, especially those with disabilities, can receive counseling assistance by e-mail madi.abilev@kaznu.edu.kz. **Integration MOOC (massive open online course).** In the case of integrating MOOC into the course, all students need to register for MOOC. The deadlines for passing MOOC modules must be strictly observed in accordance with the course study schedule. **ATTENTION!** The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course, as well as in the MOOC. Failure to meet deadlines results in loss of points.

INFORMATION ABOUT TEACHING, LEARNING AND ASSESSMENT

Score-rating letter system of assessment of accounting for educational achievements				**Assessment Methods**
Grade	**Digital equivalent points**	**points, % content**	**Assessment according to the traditional system**	**Criteria-based assessment** is the process of correlating actual learning outcomes with expected learning outcomes based on clearly defined criteria. Based on formative and summative assessment. **Formative assessment is** a type of assessment that is carried out in the course of daily learning activities. It is the current measure of progress. Provides an operational relationship between the student and the teacher. It allows you to determine the capabilities of the student, identify difficulties, help achieve the best results, timely correct the educational process for the teacher. The performance of tasks, the activity of work in the classroom during lectures, seminars, practical exercises (discussions, quizzes, debates, round tables, laboratory work, etc.) are evaluated. Acquired knowledge and competencies are assessed.
A	4.0 _	95-100	Great	
A-	3.67	90-94		
B+	3.33	85-89	Fine	

				Summative assessment - type of assessment, which is carried out upon completion of the study of the section in accordance with the program of the course. Conducted 3-4 times per semester when performing IWS. This is the assessment of mastering the expected learning outcomes in relation to the descriptors. Allows you to determine and fix the level of mastering the course for a certain period. Learning outcomes are evaluated.	
B	3.0	80-84		**Formative and summative assessment**	**Points % content**
B-	2.67	75-79		Work in laboratory classes	27
C+	2.33	70-74		Independent work	18
C	2.0	65-69	Satisfactorily	Colloquium	15
C-	1.67	60-64		Final control (exam)	40
D+	1.33	55-59	Unsatisfactory	TOTAL	100
D	1.0	50-54			

Calendar (schedule) for the implementation of the content of the course. Methods of teaching and learning.

A week	Topic name	Number of hours	Max. ball
	MODULE 1. Fundamental concepts		
1	**Lec 1.** Separation processes. Thermodynamics of separation operations	1	-
	Lab 1.	4	7
2	**Lec 2.** Mass transfer and diffusion	1	-
	Lab 2.	4	8
	IWST 1. Consultation on the implementation of IWS1	1	-
3	**Lec 3.** Single equilibrium stages and flash calculations	1	-
	Lab 3.	4	7
	IWS 1.		15
4	**Lec 4.** Cascades and hybrid systems	1	-
	Lab 4.	4	8
	MODULE 2. Separations by phase addition or creation		
5	**Lec 5.** Absorption and stripping of dilute mixtures	1	-
	Lab 5.	4	7
	IWST 2. Consultation on the implementation of IWS2	1	-
6	**Lec 6.** Distillation of binary mixtures	1	-
	Lab 6.	4	8
	IWS 2.		15
7	**Lec 7.** Liquid-liquid extraction with ternary systems	1	-
	Lab 7. Colloquium (written)	4	25
Midterm control 1			**100**
8	**Lec 8.** Approximate methods for multicomponent, multistage separations	1	
	Lab 8.	4	6
	IWST 3. Consultation on the implementation of the IWS3	1	
9	**Lec 9.** Equilibrium-based methods for multicomponent absorption, stripping, distillation, and extraction	1	
	Lab 9.	4	6
10	**Lec 10.** Enhanced distillation and supercritical extraction	1	
	Lab 10.	4	7
	IWS 3.		15
	MODULE 3. Separations by barriers and solid agents		
11	**Lec 11.** Membrane separations	1	
	Lab 11.	4	7
	IWST 4. Consultation on the implementation of the IWS4	1	
12	**Lec 12.** Adsorption, Ion Exchange, and Chromatography	1	
	Lab 12.	4	7
	IWS 4.		15
	MODULE 4. Separations that involve a solid phase		
13	**Lec 13.** Leaching and Washing	1	
	Lab 13.	4	6
14	**Lec 14**. Crystallization, Desublimation, and Evaporation	1	
	Lab 14.	4	6
15	**Lec 15.** Drying of Solids	1	
	Lab 15. Colloquium (written)	4	25
	IWST 5. Consultation on preparation for the exam	1	

Midterm control 2	**100**
Final control (exam)	**100**
TOTAL for course	**100**

Dean _____ A. Galeyeva

Head of Department _____ A. Argimbayeva

Lecturer _____ M. Abilev