Course code: 02-EMS-SO-SP2 **Plan position:** ……

A. INFORMATION ABOUT THE COURSE

B. Basic information

Name of course	***Separation Operations***
Field of studies	
Profile of studies	General academic
Form of studies	Stationary
Specialty	
Unit responsible for the field of studies	Faculty of Chemical Technology and Engineering/ Division of Chemical and Biochemical Engineering
Name and academic degree of teacher(s)	Justyna Miłek, Professor Sylwia Kwiatkowska-Marks, PhD, Ilona Trawczyńska, PhD
Introductory courses	
Introductory requirements	

C. Semester/week schedule of classes

Semester	Lectures (W)	Auditorium classes (Ć)	Laboratory classes (L)	Project classes (P)	Seminar (S)	Field classes (T)	Number of ECTS points
Summer	20			15			7

2. LEARNING OUTCOME

No.	Learning outcomes description	The reference to the learning outcomes of specific field of study	The reference to the learning outcomes for the area
KNOWLEDGE			
W1	The student has knowledge in the field of chemical engineering.	K_W13	P6S_WG
W2	The student knows the basic methods, techniques, tools and materials used in solving simple engineering tasks related to technology and chemical engineering.	K_W15	P6S_WG
SKILLS			
U1	The student uses knowledge to design and implement simple chemical processes and unit operations. He can explain the basic phenomena related to important processes in chemical technology and engineering.	K_U07	P6S_UW
U2	The student uses the principles of saving raw materials and energy.	K_U16	P6S_UW

U3	The student solves simple engineering tasks related to the implementation of processes and unit operations.	K_U18	P6S_UW

3. TEACHING METHODS

A. Traditional methods used

Standard lecture with presentation. Project classes performed by students under supervision of academic staff. Outdoor classes - visits of production companies.

4. METHODS OF EXAMINATION

Written exam from lectures during summer examination session.

5. SCOPE

Lectures	Introduction to separation processes. The evaporators types and equipment (single-effect and multiple-effect evaporators, vapor recompression evaporator). Flash, simple batch and continuous distillation. Steam distillation. Total reflux, minimum reflux and tray efficiency. McCabe-Thiele method. Extractive distillation, azeotropic distillation. Liquid-liquid extraction and solid-liquid extraction. Absorption. Membrane processes.
Project	Project of the plate rectifying column.

6. METHODS OF VERIFICATION OF LEARNING OUTCOMES

LEARNING OUTCOME	Form of assessment					
	Oral examination	Written exam	Colloquium	Project	Presentation	Reports
W1		x				
W2		x				
U1		x		x		
U2				x		
U3				x		

7. LITERATURE

Basic literature	1. McCabe W.L., Smith J.L.: Unit operations of chemical engineering. McGraw-Hill's, New York, 1985. 2. Chpey N. P.: Handbook of Chemical Engineering Calculations. McGraw – Hill's, New York, 2004. 4. Wankat P. C.: Separation Process Engineering: Includes Mass Transfer Analysis, Prentice Hall, 2016. 5. Pabby A.K., Rizvi S.H., Sastre A.M.: Handbook of membrane separations chemical, pharmaceutical, food, and biotechnological applications. CRC Press. cop. 2015.
Supplementary literature	1. http://en.wikibooks.org/wiki/Introduction_to_Chemical_Engineering_Processes 2. Perry R.H. Green D.W. Perry's Chemical Engineers' Handbook. Mc Graw – Hill, New York. 1997.

8. TOTAL STUDENT WORKLOAD REQUIRED TO ACHIEVE EXPECTED LEARNING OUTCOMES EXPRESSED IN TIME AND ECTS CREDITS

Student's activity		Student workload– number of hours
Classes conducted under a direct supervision of an academic teacher or other persons responsible for classes	Participation in classes indicated in point 1C	35
	Supervision hours	20
Student's own work	Preparation for classes	45
	Reading assignments	25
	Other (preparation for exams, tests, carrying out a project etc)	50
Total student workload		175
	Number of ECTS points	**7**