Zał. nr 5 do ZW 78/2023

Attachment no. 4. to the Program of Studies

FACULTY of Chemistry

SUBJECT CARD

Name of subject in Polish Projektowanie instalacji przemysłowych
Name of subject in English Industrial plants design principles
Main field of study (if applicable): Chemical Engineering and Technology
Specialization (if applicable): Advanced Chemical Technologies
Profile: academic
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code W03CET-SM2014W, W03CET-SM2014P
Group of courses NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15			30	
Number of hours of total student workload (CNPS)	30			60	
Form of crediting (Examination / crediting with grade)	Crediting with grade			Crediting with grade	
For group of courses mark (X) final course					
Number of ECTS points	**1**			**2**	
including number of ECTS points for practical classes (P)				2	
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0.6			1,2	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of unit operations in chemical and process engineering.
2. Basics of process design.
3. Knowledge of process equipment.

SUBJECT OBJECTIVES

C1 Providing the students with industrial plant design tasks and feasibility analysis of the new plant, rules of the integrated project elaboration.
C2 Providing the students with basic knowledge of raw materials and energy supply systems, requirements concerning raw materials and products quality, optimization and intensification of integrated process.
C3 Providing the students with the rules of production process course elaboration, including the rules of elaboration of schematic diagram and a technological-apparatus scheme of the integrated process.
C4 Providing the students with the rules of process equipment selection, apparatus constructions, constructional materials, methods of selection of control-measuring apparatuses and regulation equipment of the plant under design.
C5 Presentation of investment costs estimation and calculation of production costs of the designed integrated process.
C6 Making project of the of an integrated process.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:
PEU_W01 – knows basics of unit operations design,
PEU_W02 – knows process intensification rules,
PEU_W03 – has thorough knowledge as far as concerning the apparatus and equipment used in industrial plants.

relating to skills:
PEU_U01 – can make design calculations of selected unit operations in integrated processes,
PEU_U02 – can integrate the processes,
PEU_U03 – can select the sequence of unit operations for technological process in the plant (integrated processes) designs.

relating to social competences:
PEU_K01 – can cooperate in design group,
PEU_K02 – can present the work results.

PROGRAMME CONTENT

	Lecture	**Number of hours**
Lec 1	Integration of unit operations. Industrial plant. Industrial plant design principles. Feasibility analysis of the new plant.	2
Lec 2	Process integration rules. Technological – economic assumptions. Elaboration rules of the process project of industrial plant. Optimization of process solutions.	2
Lec 3	Examples of integrated processes application. Process data. Raw materials and the products, energy, waste. Parameters of unit operations. Integrated process course.	2
Lec 4	Principles balancing rules. Process equipment, industrial plant, constructional materials.	2
Lec 5	Control and regulation of designed integrated process – industrial plant.	2
Lec 6	Technological – apparatus scheme of integrated processes. Spatial distribution of apparatus and equipment in industrial plant.	2
Lec 7	Investment costs and calculation of project cost.	2
Lec 8	Analysis of advantages resulting from process integration – examples of real process solutions.	1
	Total hours	**15**

	Project	**Number of hours**
Proj 1	Feasibility analysis of a new (exemplary) investment.	2
Proj 2	Elaboration of chemical and technological concept of the design task – an exemplary industrial plant.	2
Proj 3, Proj 4	Selection of individual parameters of unit operations for specified design task – integrated proces – according to elaborated schematic diagram of the designed integrated process.	4
Proj 5 – Proj 7	Calculation of material and energy balances, calculation of indicators of raw material and energy consumption in integrated process. Calculating of the product/products composition, waste composition and elaboration of their storage/utilization method.	6
Proj 8 – Proj 10	Selection and/or design of process apparatuses, equipment selection, selection of constructional materials for integrated process.	6
Proj 11	Elaboration of measurement, control and regulation system of integrated process. Selection of control and measurement equipment. Selection of automatic control systems.	2
Proj 12, Proj 13	Elaboration of technological-apparatus scheme of the integrated process. Spatial distribution of apparatuses and equipment.	4
Proj 14, Proj 15	Estimated investment costs and production costs.	4
	Total hours	**30**

TEACHING TOOLS USED

N1. Lecture with multimedia presentation.
N2. Integrated project of the given task – elements of individual and group work.
N3. Design consultations.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming during semester), P – concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P1	PEU_W01 – PEU_W03	Crediting with grade.
P2	PEU_U01 – PEU_U03, PEU_K01-PEU_K02	Crediting with grade. Project evaluation.

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] R. Koch, A. Kozioł: *Dyfuzyjno–cieplny rozdział substancji*, WNT Warszawa, 1994.
[2] R. Koch, A. Noworyta: *Procesy mechaniczne w inżynierii chemicznej*, WNT Warszawa, 1995.
[3] A. Burghardt, G. Bartelmus: *Inżynieria reaktorów chemicznych*, PWN Warszawa, 2001.
[4] S. Kucharski, J. Głowiński: *Podstawy obliczeń projektowych w inżynierii chemicznej*, OWPWr, Wrocław, 2000.
[5] D.W. Green, R.H. Perry (red.): *Perry's chemical engineers' handbook*, 8th ed., McGraw–Hill, 2007

SECONDARY LITERATURE:

[1] W.D. Seider: *Process design principles*, J.W.&S., 1999.
[2] U. Bröckel, W. Meier, G. Wagner (red.): *Product design and engineering.* Vol.1*: Basics and technologies,* Vol. 2: *Raw materials, additives and application*, Wiley, 2007.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

Dr inż. Anna Stanclik (anna.stanclik@pwr.edu.pl)
Dr inż. Nina Hutnik (nina.hutnik@pwr.edu.pl)