

FACULTY OF CHEMISTRY					
SUBJECT CARD					
Name of subject in Polish Podstawy inżynierii chemicznej i procesowej					
Name of subject in English Fundamentals of chemical and process engineering					
Main field of study (if applicable): all fields of 2nd level studies					
Specialization (if applicable):					
Profile: academic					
Level and form of studies: 2nd level, supplementary semester (full-time)					
Kind of subject: obligatory					
Subject code W03W03-SM2028W, W03W03-SM2028P					
Group of courses NO					
	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			30	
Number of hours of total student workload (CNPS)	50			50	
Form of crediting (Examination / crediting with grade)	Examination			Crediting with grade	
For group of courses mark (X) final course					
Number of ECTS points	2			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)	1.3			1.5	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic principles of chemical engineering.
2. Basic principles of chemical technology.

SUBJECT OBJECTIVES

- C1 Providing the students with the rules of production process design.
- C2 Acquiring fundamental knowledge about design procedures and use of this knowledge for solving problems and engineering tasks concerning momentum, heat and mass transfer processes.
- C3 Providing the students with the rules of elaboration of production process course in designed plant, rules of general process scheme elaboration, mass and heat balances elaboration, principles of technological-equipment scheme elaboration.
- C4 Providing the students with the rules of process apparatuses and equipment selection, with design rules of basic process equipment for momentum, heat and mass transfer processes, selection rules of control and measurement instruments.
- C5 Acquiring the fundamental knowledge about calculation methods (design algorithms) of basic equipment in processes and unit operations of momentum, heat and mass transfer processes.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

- PEU_W01 – knows the design rules of production process, knows the rules of elaboration of process project of the industrial plant,
- PEU_W02 – knows the design procedures and can apply them for solving the problems and engineering tasks in momentum, heat and mass transfer processes,

PEU_W03 – can elaborate the production process course, elaborate general and technological-equipment schemes, make mass and energy balances for the designed process,
 PEU_W04 – can design the basic, simple process equipment used in processes and unit operations of momentum, heat and mass transfer.

relating to skills:

PEU_U01 – can determine productability / economic capacity of batch or continuous plant,
 PEU_U02 – can formulate design problems and solve engineering tasks in processes and unit operations of momentum, heat and mass transfer in production processes, including: flow resistances in the apparatuses, balancing the mass and heat streams, process kinetics, characteristics of pipelines, pump selection, sedimentation, filtration, heat transfer and heat exchangers, mass transfer and mass exchangers (e.g. absorption, adsorption, extraction, crystallization), batch and continuous stirred reactors,
 PEU_U03 – can make general scheme of production process, propose technological-equipment scheme,
 PEU_U04 – can select and design basic process equipment used in processes and unit operations of momentum, heat and mass exchange.

relating to social competences:

PEU_K01 – can cooperate in a design and laboratory group,
 PEU_K02 – can present the results of the work.

PROGRAMME CONTENT

Lecture		Number of hours
Lec1	Stages of new technology elaboration. Technical-economical assumptions, process design, technical design.	2
Lec2	Design procedures. Rules of the process project elaboration. Design assumptions. Productability / economic capacity of batch or continuous plant.	2
Lec3	Processes and unit operations of momentum transfer. Hydrodynamics, pumps, sedimentation, filtration, mixing and mixers.	2
Lec4	Processes and unit operations of heat transfer. Conduction and heat transfer, interphase heat transfer, heat exchangers.	2
Lec5	Processes and unit operations of mass transfer. Absorption, adsorption, extraction, distillation – mass exchangers.	2
Lec6	Processes and unit operations of mass transfer (continuation). Crystallization, crystallizers, stirred chemical reactors.	2
Lec7	Production process course. Process data, general scheme of production process. Raw materials, products, wastes, environment protection.	2
Lec8	Material and energetic balances. Indicators of raw materials and energy consumption.	2
Lec9	Selection of process equipment and apparatuses. Selection of constructional materials.	2
Lec10	Technological-equipment scheme of the designed production process. Selection of measurement and control instruments.	2
Lec11	Process equipment requiring individual design. Design algorithms of basic equipment for momentum transfer processes.	2
Lec12	Process equipment requiring individual design. Design algorithms of basic equipment for heat transfer processes.	2
Lec13	Process equipment requiring individual design. Design algorithms of basic equipment for mass transfer processes.	2
Lec14	Design of batch or continuous stirred chemical reactors.	2

Lec15	Technical safety of the plant. Rules of investment costs and exploitation costs estimation.	2
	Total hours	30
Project		Number of hours
Proj1	Calculation of productability / economic capacity of continuous and batch plants.	2
Proj2, Proj3	Calculations in selected unit operations of momentum transfer: flows in pipeline system and process equipment, sedimentation, filtration, mixing.	4
Proj4	Calculations in selected unit operations of heat transfer: conduction, heat transfer, interphase heat transfer.	2
Proj5, Proj6	Calculations in selected unit operations of mass transfer: absorption, adsorption, extraction, distillation, crystallization, stirred tank chemical reactors.	4
Proj7	Material balances for exemplary production processes, calculation of raw materials consumption indicators.	2
Proj8	Energy balances for exemplary production processes, calculation of energy consumption indicators.	2
Proj9	Elaboration of general scheme of production process, technological-equipment scheme of industrial plant.	2
Proj10	Design of flow tank, pump selection.	2
Proj11	Design of heat exchanger.	2
Proj12	Design of mixer.	2
Proj13	Design of batch and continuous stirred reactor.	2
Proj14	Design of continuous crystallizer with internal circulation of suspension.	2
Proj15	Credit test.	2
	Total hours	30
TEACHING TOOLS USED		
N1. Lecture with multimedia presentation. N2. Solving of engineering and design problems. N3. Project 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
P (lecture)	PEU_W01 – PEU_W04	Examination.
P2 (project)	PEU_U01 – PEU_U04	Crediting with grade.
PRIMARY AND SECONDARY LITERATURE		

PRIMARY LITERATURE:

- [1] J. Ciborowski: *Podstawy inżynierii chemicznej*, WNT, Warszawa, 1982.
- [2] J. Pikoń: *Aparatura chemiczna*, PWN, Warszawa, 1978.
- [3] D.W. Green, R.H. Perry (red.): *Perry's chemical engineers' handbook*, 8th ed., McGraw-Hill, 2007.
- [4] S. Kucharski, J. Głowiński: *Podstawy obliczeń projektowych w inżynierii chemicznej*, OWPWr, Wrocław, 2000.
- [5] Pr. zbiorowa: *Zadania projektowe z inżynierii procesowej*, OWPW, Warszawa, 1986.

SECONDARY LITERATURE:

- [1] Himmelblau: *Basic principles and calculation in chemical engineering*, N. Y., 1986.
- [2] G.I. Wells, L.M. Rose: *The art of chemical process design*, Elsevier, 1986.
- [3] W.D. Seider: *Process design principles*, J.W.&S., 1999.
- [4] U. Bröckel, W. Meier, G. Wagner (red.): *Product design and engineering*. Vol. 1: *Basics and technologies*, Vol. 2: *Rawmaterials, additives and application*, Wiley, 2007.

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

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