Detailed course description
(SUBJECT CARD)

Course title: **Process System Engineering**
Course code:
Classification of a course group:
Course type: ~~basic~~ / field-related/ general/ specialty-related*
obligatory / ~~elective~~*
Field of study: **Industrial and Engineering Chemistry**
Level of study: ~~first-cycle~~ / second-cycle*
Profile of study: general academic ~~/ practical~~*
Mode of study: full-time programme / ~~part-time programme~~*
Specialty (specialisation): Process Engineering and Green Chemical Technologies
Year of study: 1
Semester: 1
Teaching modes and teaching hours:
lectures – 45 h;
classes – 15 h.
Language/s of instruction: English
Number of ECTS credits *(according to the study programme)*: 4
* – *leave the appropriate option*

1. Course objectives:

   An objective of the course is providing the students with theoretical and practical background of process plants design, as well as rules of rational selection and matching unit operations into technological process line.

2. Relation of the field-related learning outcomes to modes of teaching and methods of verification as well as to assessment of student's learning outcomes:

symbol	assumed learning outcomes *a student who completed the course:*	teaching modes	verification methods and learning outcomes assessment
Knowledge: a student knows and understands			
K2A_W04	Student has knowledge of the theoretical foundations of issues related to the design of process installations	Lecture Classes	Exam Test
Skills: a student can			
K2A_U07	Student is able to put into practice multi-level design methods - from the chemical concept of the process to full documentation of the process design	Lecture Classes	Exam Test
K2A_U09	Student is able to apply in practice heuristic rules regarding the selection of the optimal process configuration	Lecture Classes	Exam Test
	Student can use literature data, information and communication techniques as well as specialist calculation and simulation programs for calculation and design works	Lecture Classes	Exam Test
K2A_U09	Student applies the principles of correct selection and integration of unit operations into the technological line	Lecture Classes	Exam Test

3. The content of study programme ensuring learning outcomes *(according to the study programme)*:

   The design process – its objectives, basic steps in designing and retrofitting of the chemical processes, new process concept. Environmental protection problems – environmental factors in process design. Safety considerations, safe chemical plants. Application of computers, computational guidelines, principles of flowsheet simulation. Detailed process creation. Heuristics for process synthesis. Process control.

4. Description of methods of determination of ECTS credits:

Type of activity	Number of hours / ECTS credits
Number of course hours regardless of a teaching mode	60/2
Preparation for a test	15/1
Preparation for an exam	30/1
Consultation	15/0
Total hours:	**120**

Number of ECTS credits allocated to a course	4

Explanation:
* – student's workload - fill in the types of activities, e.g. *preparation for a course, interpretation of results, making a course report, preparation for an exam, studying sources, making a project, presentation* and *report, doing written assignment, etc.*
** – the other e.g. *extra course hours*

5. Summary indexes:
   - number of course hours and ECTS credits at the course with a direct participation of academic teachers or other persons running the course and supervising students: 60 h / 2 ECTS
   - number of course hours and ECTS credits at the course related to the scientific activity conducted at the Silesian University of Technology in a discipline or in disciplines to which a field of study is assigned - in the case of studies with a general academic profile: 120 h / 4 ECTS
   - number of course hours and ECTS credits at the course developing practical skills- in the case of practical studies;
   - number of course hours conducted by academic teachers employed by the Silesian University of Technology as their primary workplace: 60 h
6. Persons conducting particular modes of courses (name, surname, academic degree or degree in arts, title of professor, business e-mail address):

   Dr inż. Agata Małysiak, agata.malysiak@polsl.pl
7. Detailed description of teaching modes:

   1) lectures:

   – detailed programme's content:

   The design process – its objectives, basic steps in designing and retrofitting of the chemical processes.

   Creation of the new process concept.

   Development of base case.

   Detailed process synthesis using algorithmic methods.

   Detailed design, equipment sizing, cost estimation, profitability analysis, optimization.

   Plantwide controllability assessment. Environmental protection problems – environmental factors in process design.

   Safety considerations.

   Design approaches towards safe chemical plants.

   Application of computers – basic spreadsheets, mathematical packages, process simulators (ASPEN PLUS, HYSYS, PRO/II, CHEMCAD), computational guidelines.

   Principles of flowsheet simulation.

   Detailed process creation – database preparation, thermophysical property data, role of experiments.

   Preliminary process synthesis – continuous/batch processing, chemical state of the substance, synthesis steps – unit operations, synthesis tree.

   Heuristics for process synthesis.

   Detailed process flowsheet, process integration, process simulation and pilot plant testing.

   Interaction of process design and automatic process control.

   Profitability analysis.

   – teaching methods, including distance learning:

   lecture, classes

   – form and criteria for semester completion, including retake tests, as well as conditions for admission to the examination:

   50% or more points got from test or retake test from classes + 50% or more points from exam

   – course organisation and rules of participation in the course, with an indication whether a student's attendance is obligatory

   Attendance to lectures is not obligatory, but taking a test is. Attendance to classes is mandatory. One

absence is allowed.

2) description of other teaching modes:

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8. Description of the method for determining the final grade (rules and criteria for evaluation, as well as the final grade calculation method in the case of a course comprising more than one teaching mode, taking into account all teaching modes and all exam dates and credit tests including retake exams and tests):

   Final grade is a weighted average of grades from both classes and exam calculated according to formula:

   Final grade = 0,75 * exam + 0,25 * test

9. Method and procedure for making up for

   - student's absence from the course,
   - differences in study programmes for students changing their field of study, changing university or resuming studies at the Silesian University of Technology,

   Getting acquainted with the missed material from classes, taking part in consultation hours.

10. Prerequisites and additional requirements, taking into account the course sequence:

    Knowledge provided in: Fluid Mechanics, Transport Phenomena, Process Thermodynamics, Unit Operations, Industrial Equipment and Economics.

11. Recommended sources and teaching aids:

    Douglas J.M., Conceptual Design of Chemical Processes, McGraw–Hill, New York (1988).

    Ulrich G.D., A Guide to Chemical Engineering Process Design and Economics, Wiley, New York (1984).

    Myers A.L., Seider W.D., Introduction to Chemical Engineering and Computer Calculations, Prentice–Hall, Englewood Cliffs, NJ (1976).

12. Description of teachers' competences (e.g. publications, professional experience, certificates, trainings etc. related to the programme contents implemented as a part of the course):

    Teacher has an experience in lecture topics as well as in classes documented by academic achievements (reseach papers, patents, conferences).

13. Other information:
    none