GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Principles of Processes Design and Technical Documentation Preparation, PG_00066041		
Field of study	Engineering and Technologies of Energy Carriers		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2024/2025
Education level	second-cycle studies	Subject group	Optional subject group Subject group related to practical vocational preparation
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	2.0
Learning profile	practical profile	Assessment form	assessment
Conducting unit	Department of Process Engineering and Chemical Technology -> Faculty of Chemistry		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Robert Aranowski	
	Teachers	dr inż. Robert Aranowski dr inż. Szymon Dudziak dr inż. Anna Grzegórska	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	10.0	15.0	0.0	15.0	0.0	40
	E-learning hours included: 0.0						

Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
	Number of study hours	40	5.0	5.0	50

Subject objectives	The aim of the course is to provide students with theoretical knowledge and practical skills related to the creation of technical documentation and to understand the broader context of its application. In particular, students will: Become familiar with the current standards and legal norms in technical design, which are crucial for ensuring project compliance with legal regulations and safety standards. Deepen their knowledge and skills in using advanced automation and design tools, such as CAD (Computer-Aided Design) and CAE (Computer-Aided Engineering) software. Develop skills in teamwork and technical communication, which are essential in multidisciplinary environments where designers must effectively collaborate with engineers from various fields. Manage projects, including planning, monitoring progress, and managing resources, which are key to effectively conducting technical projects. Explore issues of sustainable development, which are becoming increasingly important in the context of global ecological challenges and sustainable production. The goal of this course is not only to learn about creating documentation, the fundamentals and principles of chemical technology, creating conceptual and technological diagrams, and the principles of making balances, but also to develop critical thinking and innovation skills, which are needed to solve contemporary engineering problems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U08] develops and transmits technical information in the form of text documents, spreadsheets, graphs, technological diagrams and multimedia presentations, and prepares a speech with a multimedia presentation	Student will be able to use CAD tools as well as spreadsheets and text editors to prepare technical documentation.	[SU4] Assessment of ability to use methods and tools
[K7_U07] makes a preliminary economic assessment of the proposed solutions and engineering actions undertaken.	The student will be able to estimate the costs of manufacturing a product based on the designed installation and the created technical documentation.	[SU1] Assessment of task fulfilment
[K7_W06] defines the techniques of designing technological processes; describes the methods of selecting the right technological process; the resistance of materials to degradation, degradation mechanisms and methods of improving corrosion resistance	Student will possess the necessary knowledge to properly select equipment and its technical solutions, taking into account the corrosion resistance of materials and choosing appropriate methods to prevent it.	[SW3] Assessment of knowledge contained in written work and projects
[K7_W04] explains the relationships in the life cycle of technical devices and the basic processes occurring in the life cycle of devices, objects and technical systems,	In the context of the lifecycle, students will have knowledge of the principles of sustainable development, ensuring that the design and documentation created are socially responsible.	[SW3] Assessment of knowledge contained in written work and projects

Subject contents

Lecture

Technological principles, design heuristics. Discussion of technical documentation: site layout plan, equipment location plan, process schematic (flow diagram), isometric pipeline diagrams, environmental impact assessment, material and thermal balance, equipment power balance, auxiliary media balance, P&ID schematics, hazard analysis and operational capability report, three-dimensional visualization of the installation, process specifications, technical-operational documentation of equipment and industrial installations, assembly drawings of devices, explosion protection document, licensing agreements for the use of the technological process. Creation of detailed pipeline planning documentation including fittings, tanks, and heat exchangers.

Project

Groups will work on selected technological projects. This process begins with gathering information about the process, including its history, applications, key reactions, and materials used. Then, the teams create conceptual and flow diagrams. In terms of material and energy balances, groups will perform calculations aimed at enhancing energy efficiency and optimizing raw material consumption. The project will also include selecting appropriate equipment, including reactors, heat exchangers, and distillation columns.
The next step is assessing the environmental impact of the project, including analyzing emissions, waste, and other potential environmental hazards. Groups will also develop safety protocols and emergency plans related to the management of chemical substances and processes.
As part of the economic analysis, teams will estimate the capital costs required to initiate the process and perform calculations related to the return on investment and the break-even point. The work will conclude with the preparation of comprehensive technical documentation, including reports, drawings, and schematics. The projects will be presented to the group and potential reviewers, during which the results, methods, and design assumptions will be discussed.

Exercises

Performing balance calculations:

- Material balance: Conducting calculations of the inflow and outflow of materials in chemical processes, adhering to the principles of mass balance.
- Energy balance: Calculations related to energy needs and energy efficiency in technological processes.

Designing diagrams:

- CAD software exercises: Practical use of CAD programs to create conceptual, flow, and technical drawings of installation systems.

Cost analysis:

- Capital and operational costs: Estimating expenses associated with the construction and operation of technical installations.
- Profitability analysis: Performing calculations of return on investment and determining the break-even point for various operational scenarios.

Prerequisites and co-requisites	Basic components knowledge of basic components of the process design, the basics and principles of chemical technology, the idea and technological scheme, the principles of preparation a flow, mass and energy balance, principles of technical drawings, basic organic and inorganic technologies, construction of machines and apparatus of the chemical industry

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
	60.0%	30.0%
	60.0%	30.0%
	60.0%	40.0%

Recommended reading

Basic literature	1. *Ludwik Synoradzki, Jerzy Wisialski, Projektowanie procesów technologicznych. Bezpieczeństwo procesów chemicznych, Politechnika Warszawska, 2012,* 2. *Adam Gołuch, Projektowanie - instalacje sanitarne i elektryczne: symbole i oznaczenia graficzne, normy obliczania i projektowania, wymagania, polskie normy, Kanon, 1998* 3. *Mirosław Żurek, Projektowanie instalacji budowlanych, Instytut Technologii Eksploatacji Państwowy Instytut Badawczy, Radom 2005,* 4. *Osikowicz Łukasz, Szczerba Krzysztof, Zasady bezpiecznej eksploatacji obiektów, Wydawnictwo Centrum Naukowo-Badawczego Ochrony Przeciwpożarowej, Józefów 2012,* 5. *Konrad Bąkowski, Sieci i instalacje gazowe, Wydawnictwo Naukowe PWN, Warszawa 2014,* 6. *Jacek Jeżewski, Wprowadzenie do projektowania systemów technologii chemicznej, cz. I, Teoria, Rzeszów 2001* 7. *Jacek Jeżewski, Wprowadzenie do projektowania systemów technologii chemicznej, cz. II, Przykłady, Rzeszów 2002* 8. *PN-EN 60079-10-1 Atmosfery wybuchowe: Klasyfikacja przestrzeni Gazowe atmosfery wybuchowe,* 9. *PN-EN 61882:20016-07 - Badania zagrożeń i zdolności do działania (badania HAZOP) -- Przewodnik zastosowań*
Supplementary literature	1. *PN-E-08350-14:2002 Systemy sygnalizacji pożarowej. Projektowanie, zakładanie, odbiór, eksploatacja i konserwacja instalacji,* 2. *PN-ISO 8421-7:2000 Ochrona przeciwpożarowa. Terminologia. Środki wykrywania i tlumienia wybuchu,* 3. *Rozporządzenie ministra pracy i polityki socjalnej z 26 września 1997 r. w sprawie ogólnych przepisów bezpieczeństwa i hieny pracy* 4. *Ustawa z dnia 24 sierpnia 1991r. o ochronie przeciwpożarowej,*
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	Prepare a technological project of a nitrobenzene production plant - scale 200,000 tons per year.Based on the technological project, prepare a simulation of the methanol production process using ChemCAD.List and discuss the elements of the technological project of the industrial installationList and characterize at least the necessary elements of technical documentation of the presented device / installation.Name following symbols used in the technical documentation according to the appropriate nomenclature.
Work placement	Not applicable

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