GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Computer-aided design, PG_00068922		
Field of study	Cosmetic technologies		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
Education level	first-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Process Engineering and Chemical Technology -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Robert Aranowski	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	40.0	0.0	0.0	55

E-learning hours included: 0.0

eNauczanie source addresses:

Moodle ID: 9327 Projektowanie Wspomagane Komputerowo, Technologie Kosmetyczne, 2026/27-01 https://enauczanie.pg.edu.pl/2025/course/view.php?id=9327

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	55	5.0	40.0	100

Subject objectives

The aim of the course is to familiarise students with computer-aided methods for designing products and technological processes in the cosmetics, detergents, and household chemicals industries. Students acquire skills in formulation development, performing material balances and technological calculations, process modelling, data analysis, and preparing technical documentation using digital tools, including artificial intelligence.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W04] selects data analysis methods, including statistical, modeling and artificial intelligence, useful for solving technological and scientific problems in the field of cosmetic technology and related fields	understands and selects appropriate methods for computer-aided data analysis, process modelling, and optimisation, and recognises the capabilities and limitations of AI tools in cosmetic product design.	[SW3] Assessment of knowledge contained in written work and projects
[K6_U01] designs experiments in accordance with the state of knowledge and the latest scientific literature, using computer data analysis methods	is able to develop a process concept or product formulation based on scientific literature, performs calculations and data analysis using computer-based tools, and presents the results in technical documentation.	[SU1] Assessment of task fulfilment
[K6_W07] has knowledge of designing experiments while maintaining intellectual property protection and the principles of bioethics and applicable legal regulations	understands the basic principles of using and documenting information sources, data, and digital tools in technological process design, taking into account intellectual property protection and applicable regulations. Assessment methods: laboratory assignments and project documentation.	[SW3] Assessment of knowledge contained in written work and projects

<table>
<tr><td>Subject contents</td><td>Course content – lecture

Digitalisation of the cosmetics, detergents, and household chemicals industries. The role of computer-aided design in product development and technological process design. Overview of digital tools used by process technologists, including spreadsheets, computational and simulation software, and data management systems. Computer-aided formulation design for cosmetic and detergent products, raw material selection, and product property analysis. Fundamentals of mathematical modelling of technological processes, preparation of material and energy balances, and performance of engineering calculations. Computer-based methods for analysing, processing, and visualising experimental and process data. Fundamentals of formulation and process parameter optimisation. Applications of artificial intelligence in data analysis, computer-aided product design, information retrieval, and preparation of technical documentation. Limitations of AI tools, reliability of generated results, and principles of responsible use of digital technologies. Industrial case studies illustrating computer-aided design applications in cosmetics, detergents, and household chemical technologies.

Course content – laboratory

Application of spreadsheets and specialised software for engineering calculations and data analysis. Development of cosmetic and detergent product formulations, calculation of component proportions, unit conversions, and analysis of raw material costs and alternative formulations. Preparation of material balances for technological processes, including mixing, dilution, concentration, and separation. Development of block flow diagrams and process flow diagrams (PFDs) using computer-aided tools. Modelling of selected unit operations and analysis of the influence of process parameters on their performance and efficiency. Processing and analysis of experimental and process data, including regression, interpolation, and visualisation of computational results. Fundamentals of computer-aided optimisation of product formulations and technological process parameters. Practical application of artificial intelligence tools to support calculations, data analysis, and technical documentation, with particular emphasis on critical assessment and verification of generated results. Completion of a team project involving the design of a manufacturing process for a selected cosmetic or detergent product, including formulation development, selection of unit operations, preparation of material balances, development of a process flow diagram, and preparation of technical documentation.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Basic computer and spreadsheet skills, as well as fundamental knowledge of chemistry and chemical technology, are recommended.</td></tr>
<tr><td>Assessment methods and criteria</td><td>
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<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Knowledge test – Lecture</td><td>60.0%</td><td>20.0%</td></tr>
<tr><td>Mini-project in technological design – Laboratory Final project – Laboratory</td><td>60.0%</td><td>20.0%</td></tr>
<tr><td>Project consultations – Laboratory</td><td>0.0%</td><td>10.0%</td></tr>
<tr><td>Knowledge test – Lecture</td><td>60.0%</td><td>30.0%</td></tr>
<tr><td>Mini-quizzes – Lecture</td><td>60.0%</td><td>20.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. Sinnot R.K., Towler G., Chemical Engineering Design, Elsevier, Oxford,2020.
2. Seider W.D., Seader J.D., Lewin D.R., Widagdo S., Product and Process Design Principles, Wiley, Hoboken, 2017.
3. Turton R., Bailie R.C., Whiting W.B., Shaeiwitz J.A., Bhattacharyya D.,Analysis, Synthesis and Design of Chemical Processes, Prentice Hall, 2018.
4. Chylińska M., Szyjewski Z., Informatyka w przedsiębiorstwie przemysłowym [Information Technology in an Industrial Enterprise], PWE, Warsaw, 2019.</td></tr>
<tr><td>Supplementary literature</td><td>1. Documentation for CHEMCAD, DWSIM, and Aspen Plus.
2. Excel and LibreOffice Calc training materials.
3. Documentation of AI tools used for data analysis and computer-aided design.
4. Scientific articles on the digitalisation of cosmetics and detergent manufacturing.
5. Reports published by Cosmetics Europe and AISE.</td></tr>
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	eResources addresses	Supplementary https://cosmeticseurope.eu/resources/?utm_source=chatgpt.com - Information on chemical process simulation, modelling, optimisation, and process performance analysis. Access to detailed documentation may require a user account. Industry reports, statistics, scientific publications, and materials related to the safety and development of the cosmetics industry. Some resources require payment. https://aise.eu/?utm_source=chatgpt.com - Information on chemical process simulation, modelling, optimisation, and process performance analysis. Access to detailed documentation may require a user account. Industry reports, statistics, scientific publications, and materials related to the safety and development of the cosmetics industry. Some resources require payment. Industry-specific materials on detergents, cleaning products, product safety, and sustainable development. This is the organisation's homepage rather than a direct link to a specific report. https://chemstations.com/hubfs/Datacor-Chemstations/PDF/CHEMCAD_User_Guide.pdf?utm_source=chatgpt.com - Documentation for chemical process simulation software, covering the development of process flow diagrams, stream definition, and process simulation. chemstations.com https://dwsim.org/help/main/?utm_source=chatgpt.com - User manual and examples of unit operation modelling, thermodynamic calculations, and process simulation. dwsim.org https://www.aspentech.com/en/products/engineering/aspen-plus?utm_source=chatgpt.com - Information on chemical process simulation, modelling, optimisation, and process performance analysis. Access to detailed documentation may require a user account.
Example issues/ example questions/ tasks being completed	Example assignments: Calculation of the composition and cost of a cosmetic formulation; material balance of a mixing process; development of a process flow diagram for emulsion production; modelling of a selected unit operation; analysis of experimental data and visualisation of results; evaluation of the accuracy and reliability of AI-generated responses; team project involving the design of a cosmetic or detergent manufacturing process.	
Practical activites within the subject	Not applicable	

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