GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Dispersed systems, PG_00068915		
Field of study	Cosmetic technologies		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2025/2026
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	1	Language of instruction	Polish -
Semester of study	2	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Biotechnology and Microbiology -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Adam Macierzanka	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	20.0	0.0	40.0	0.0	0.0	60

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	60	3.0	37.0	100

Subject objectives

The aim of the course is to provide a broad yet detailed introduction to the chemistry and technology of colloidal systems, incorporating the latest theoretical knowledge. It also aims to present modern measurement methods used to investigate the functional properties of such systems, as well as their current industrial applications.
The course will cover topics related to the theoretical chemistry of colloids and their applications in technological processes and scientific research, with a particular focus on cosmetics

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U05] proposes solutions to technological and scientific problems in cosmetics technology and related fields using experimental methods, computer science, statistics and specialist databases	The student is able to practically apply knowledge related to the selection and use of instrumental methods in colloid technology (focused on cosmetics), and is proficient in using basic techniques for analysing the surface and interfacial properties of surfactants in dispersed systems.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
[K6_W03] selects methods and processes for producing various forms of cosmetics	The student knows the methods necessary for producing various forms of cosmetics and understands how to select them appropriately.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[K6_W05] identifies key directions of development of research, equipment and techniques in the production of cosmetics and related products	The student is aware and able to anticipate the impact of social and institutional requirements on the development of cosmetic product manufacturing technologies.	[SW1] Assessment of factual knowledge

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<tr><td>Subject contents</td><td>Course content – lecture
The lectures will focus on the theories used in the technology of colloids, their applications and associated measuring
techniques:
Fundamental theoretical knowledge of the chemistry and technology of dispersed systems as well as practical experimental science of dispersed systems, their properties and measuring techniques. These will include (but not be limited to) aspects such as:
- Definition and classification of dispersed systems and preparation techniques (condensation and dispersion methods),
- Different types of dispersed systems (foams, emulsions, microemulsions, aerosols, gels etc., characteristics of typical devices used to produce dispersed systems),
- Interactions between molecules and in macroscopic systems (physical and specific interactions, structure and parameters of the double electric layer, mechanism of the surface charge formation, potential zeta, DVLO theory etc.),
- Surface and interfacial tension, adsorption to interfaces (fundamentals of measuring techniques, wetting and contact angle phenomena etc.),
- Fundamental characterisation and properties of surfactants (structure, classification, bio-surfactants, hydrophilic-lipophilic properties, HLB value, etc.),
- Kinetic properties of dispersed systems (Brownian motion, diffusion, osmosis etc.),
- Rheological properties of dispersed systems (viscosity, viscoelasticity, micro-rheology, measuring rheological and micro-rheological properties etc.),
- Electrokinetic phenomena in dispersed systems and optical properties of dispersed systems,
- Stability of dispersed systems.

Course content – laboratory
Laboratory exercises will cover topics such as:
1. Surface tension and critical micelle concentration
2. Micellar solubilization
3. Analysis of the wetting phenomenon determination of the contact angle
4. Microscopic characterization of selected colloidal systems
5. Structure and rheology of gel systems
6. Investigation of foams and the foaming properties of surfactants
7. Solgel transition as an example of structural transformation in colloidal systems
8. Emulsions preparation and identification of type</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge of the fundamentals of physics, chemistry, and mathematics.</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>Written assessment</td><td>50.0%</td><td>60.0%</td></tr>
<tr><td>Laboratory classes</td><td>100.0%</td><td>40.0%</td></tr>
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<tr><td>Recommended reading</td><td>
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<tr><td>Basic literature</td><td>M. Fanun, Colloids in biotechnology, CRC Press 2011; I.D. Morrison, Colloidal dispersions, Wiley 2002; J. Sjoblom, Emulsions and emulsion stability, CRC Press 2006; L.D. Rhein, Surfactants in personal products and decorative cosmetics, CRC Press 2007; B.P. Binks, Modern aspects of emulsion science, RCS 1998; S.E. Friberg, Food emulsions, Marcel Dekker 1997; J.J. Wille, Skin delivery systems, Blackwell 2006; IFSCC, Introduction to cosmetic emulsions and emulsification, Micelle Press 1997; R. Zana, Dynamics of surfactant self-assemblies, Taylor & Francis 2005; G.L. Hasenhuettl, Food emulsifiers and their applications, Chapman & Hall 1997; K. Holmberg, Applied surfaces and colloid chemistry, Wiley 2002; D. Myers, Surfaces, interfaces, and colloids, Wiley-VCH 1999; M.J. Rosen, Industrial utilization of surfactants, AOCS 2000; N. Garti, Thermal behaviour of dispersed systems, Marcel Dekker 2001; L.H Tan Tai, Formulating detergents and personal care products, AOCS Press 2000; P. Ghosh, Colloid and interface science, PHI Learning Private Ltd., New Delhi, 2009; E.S. Hedges, Colloids, Hedges Press, 2007</td></tr>
<tr><td>Supplementary literature</td><td>C.E. Stauffer, Emulgatory, WNT, Warszawa 2001; H. Sonntag, Koloidy, PWN, 1982; E.T. Dutkiewicz, Fizykochemia powierzchni, WNT, Warszawa 1998; R. Zieliński, Surfaktanty, WAEP, Poznań 2000; G. Schramm, Reologia podstawy i zastosowania, OWN, Poznań 1998; L. Sobczyk, A. Kisza, Chemia fizyczna dla przyrodników, PWN, Warszawa 1977; P. W. Atkins, Podstawy chemii fizycznej, PWN, Warszawa 1999; H. Buchowski, W. Ufnalski, Roztwory, WNT, Warszawa 1995.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>What functional properties of a colloidal system may directly result from its type and structure? How can these properties be determined and modified? What production methods and equipment should be used depending on the desired type of emulsion to be produced (e.g., simple o/w and w/o emulsions, microemulsions, multiple emulsions, etc.)? Can colloidal systems of different types be combined in order to obtain a product with a specific microstructure and functional properties? If so, what criteria (e.g., physicochemical) should be taken into account? How can the stability of such products be assessed?</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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