GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	CHEMISTRY AND TECHNOLOGY OF DISPRESED SYSTEMS, PG_00065997		
Field of study	Green Technologies		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Optional subject group
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	English -
Semester of study	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	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	15.0	0.0	30.0	0.0	0.0	45
	E-learning hours included: 0.0						
	eNauczanie source addresses: Moodle ID: 2897 CHEMISTRY AND TECHNOLOGY OF DISPRESED SYSTEMS https://enauczanie.pg.edu.pl/2025/course/view.php?id=2897						

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	45	5.0	25.0	75

Subject objectives	The aim of the course is to provide a broad but detailed introduction to chemistry and technology of dispersed systems and an overview of some theoretical developments, up-to-date experimental advances and current industrial applications, with an emphasis on green technologies. This course will focus on the theories used in colloid science, their important applications and associated techniques.

Learning outcomes	<table><tr><th>Course outcome</th><th>Subject outcome</th><th>Method of verification</th></tr><tr><td>[K7_W04] identifies chemical and biological threats to the environment, taking into account anthropogenic factors</td><td>The student has acquired the knowledge necessary to identify chemical and biological environmental hazards in relation to various factors.</td><td>[SW1] Assessment of factual knowledge</td></tr><tr><td>[K7_U05] formulates and tests hypotheses related to engineering problems and simple research problems concerning environmental protection, the use of new environmental protection technologies and analytical procedures</td><td>The student has acquired the necessary knowledge in the field of equipment used in chemistry and technology of dispersed systems, taking into account theoretical and practical aspects of equipment used in green technologies.</td><td>[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</td></tr><tr><td>[K7_K01] is aware of the problems related to the profession of engineer, is able to assess the effects of the activities performed</td><td>The student is able to use the acquired knowledge of methods and mathematical-physical models to describe and explain chemical phenomena and processes, and to solve simple research and technological problems.</td><td>[SK5] Assessment of ability to solve problems that arise in practice</td></tr><tr><td>[K7_W01] identifies problems and defines tasks in the field of environmental protection technologies and modern analytical methods</td><td>The student has acquired the necessary knowledge in the field of chemistry and technology of dispersed systems, which can be used to solve practical aspects of environmental protection and the use of green technologies.</td><td>[SW1] Assessment of factual knowledge</td></tr></table>
Subject contents	Course content – lecture The lectures will focus on the theories used in colloid science, 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 The course will also focus on the translation of theoretical knowledge to practical applications through laboratory exercises. The exercises will be preceded by short written tests relevant to particular exercises. They will cover topics such as: - Determination of the hydrophilic-lipophilic properties of surfactants. The exercise aims at determining the HLB (hydrophylic-lipophylic balance) value of several surfactants, which differ in their affinity to oil and water phases, as a mean of characterising functional properties of surfactants. Students will apply the experimental method of optimal emulsion. Influence of the phase ratio and the temperature on the emulsion type, the phase inversion and the stability of emulsion systems. The aim of this exercise is to examine a phase inversion phenomenon occurring during the preparation of emulsions with different types of emulsifiers as well as determining stability of emulsions varying in the dispersed phase ratios. The stability/structure of emulsions will be assessed by methods such as measurements of backscattered laser light and the light transmitted - through emulsions. Measurements will be done immediately after emulsion preparation and after 1-2 weeks of storage. - Microemulsions and methods for their preparation. The exercise aims at obtaining a different type of emulsion systems i.e. transparent and thermodynamically stable microemulsions, and to teach students about the role of co-surfactants in stabilizing such systems. - Determination of the critical micelle concentration (CMC) in aqueous solutions of surfactants. The exercise aims at determining the CMC values of several surfactants that are commonly used in industry to stabilise dispersed systems. The CMC will be assayed by methods such as the stalagmometric method and the measurements of the conductivity of surfactant solutions.
Prerequisites and co-requisites	Basic knowledge of physical chemistry, chemical technology and biotechnolog

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lecture (written examination)	50.0%	60.0%
	Laboratory practical exercises (attendance, written tests and exercise reports)	100.0%	40.0%
Recommended reading	Basic literature	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; Recent review articles in relevant scientific journals.	
	Supplementary literature	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.	
	eResources addresses		
Example issues/ example questions/ tasks being completed	Those will be directly related to the topics described above in the class structure section.		
Practical activites within the subject	Not applicable		

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