



Subject card

Subject name and code	TECHNOLOGY OF COLLOIDAL SYSTEMS, PG_00064317						
Field of study	Chemical Technology						
Date of commencement of studies	February 2027		Academic year of realisation of subject		2026/2027		
Education level	second-cycle studies		Subject group		Optional subject group Specialty subject group Subject group related to scientific research in the field of study		
Mode of study	Full-time studies		Mode of delivery		blended-learning		
Year of study	1		Language of instruction		Polish		
Semester of study	1		ECTS credits		4.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department of Biotechnology and Microbiology -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Adam Macierzanka				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	30.0	0.0	0.0	60
	E-learning hours included: 30.0						
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		8.0		32.0	100
Subject objectives	<p>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.</p> <p>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.</p>						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_K01] critically evaluates the content of cognitive and practical problems		The student is able to apply the methods learned to describe and explain chemical and physical phenomena, as well as technological processes, and to solve simple research and technological problems.		[SK5] Assessment of ability to solve problems that arise in practice		
	[K7_U05] uses instrumental methods applied in technology and related fields		The student is able to practically apply knowledge related to the selection and use of instrumental methods in colloid technology and is proficient in using basic techniques for analysing the surface and interfacial properties of surfactants in dispersed systems.		[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment		
	[K7_W01] defines the phenomena, processes and laws of nature used to produce consumer goods and provide services		The student has acquired the essential knowledge required to relate phenomena and processes in modern colloidal system technology used for application purposes.		[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge		

Subject contents	<p>Course content – lecture</p> <p>The course content will primarily focus on practical (technological) and theoretical issues in colloid chemistry, as well as on measurement methodologies related to this field, which are applied in science and various industrial sectors utilising dispersed systems. The lecture topics will be divided into two parts:</p> <p>1. Fundamental theoretical knowledge in colloid chemistry and technology, along with practical applications of dispersed systems and the measurement methodologies used to determine their physicochemical properties. Topics will include, among others:</p> <ul style="list-style-type: none"> • Definition and classification of colloids, and methods of their preparation (condensation and dispersion methods), • Various types of colloids (foams, emulsions, microemulsions, aerosols, gels, etc.), including the basic equipment used for producing dispersed systems, • Intermolecular interactions and interactions between macroscopic systems (physical and specific interactions, electric double layer (EDL), the mechanism of surface charge formation, structure and parameters of the EDL, zeta potential, DLVO theory, etc.), • Surface and interfacial tension, and adsorption at phase boundaries (fundamentals of measurement methods, wetting and contact angle, etc.), • General characteristics and properties of surfactants (structure, classification, biosurfactants, hydrophilic-lipophilic balance (HLB), etc.), • etc. <p>2. Colloids in industry and scientific research. Topics covered will include, among others:</p> <ul style="list-style-type: none"> • Modern measurement methods used to characterise the physicochemical properties of dispersed systems, • Application of colloids as carriers of bioactive substances in cosmetics and cosmeceuticals, pharmaceuticals, etc., • etc. <hr/> <p>Course content – laboratory</p> <p>Laboratory exercises will cover topics such as:</p> <ol style="list-style-type: none"> 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
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	8. Emulsions preparation and identification of type		
Prerequisites and co-requisites	A general knowledge of the fundamentals of physical chemistry, chemical technology, and biotechnology.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lectures - written examination	50.0%	60.0%
	Laboratory classes - – tests and reports on completed laboratory exercises	100.0%	40.0%
Recommended reading	Basic literature	<p>M. Fanun, <i>Colloids in biotechnology</i>, CRC Press 2011; I.D. Morrison, <i>Colloidal dispersions</i>, Wiley 2002; J. Sjoblom, <i>Emulsions and emulsion stability</i>, CRC Press 2006; L.D. Rhein, <i>Surfactants in personal products and decorative cosmetics</i>, CRC Press 2007;</p> <p>B.P. Binks, <i>Modern aspects of emulsion science</i>, RCS 1998; S.E. Friberg, <i>Food emulsions</i>, Marcel Dekker 1997; J.J. Wille, <i>Skin delivery systems</i>, Blackwell 2006; IFSCC, <i>Introduction to cosmetic emulsions and emulsification</i>, Micelle Press 1997; R. Zana, <i>Dynamics of surfactant self-assemblies</i>, Taylor & Francis 2005; G.L. Hasenhuettl, <i>Food emulsifiers and their applications</i>, Chapman & Hall 1997; K. Holmberg, <i>Applied surfaces and colloid chemistry</i>, Wiley 2002; D. Myers, <i>Surfaces, interfaces, and colloids</i>, Wiley-VCH 1999; M.J. Rosen, <i>Industrial utilization of surfactants</i>, AOCs 2000; N. Garti, <i>Thermal behaviour of dispersed systems</i>, Marcel Dekker 2001; L.H Tan Tai, <i>Formulating detergents and personal care products</i>, AOCs Press 2000; P. Ghosh, <i>Colloid and interface science</i>, PHI Learning Private Ltd., New Delhi, 2009; E.S. Hedges, <i>Colloids</i>, Hedges Press, 2007;</p> <p><i>Current review articles in scientific journals.</i></p>	

	Supplementary literature	<p>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. Kiswa, Chemia fizyczna dla przyrodników, PWN, Warszawa 1977; P. W. Atkins, Podstawy chemii fizycznej, PWN, Warszawa 1999; H. Buchowski, W. Ufnalski, Roztwory, WNT, Warszawa 1995.</p>
	eResources addresses	
Example issues/ example questions/ tasks being completed	<p>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?</p>	
Practical activities within the subject	Not applicable	

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