



## Subject card

Subject name and code	Colloid Systems , PG_00052969						
Field of study	Chemistry in Construction Engineering						
Date of commencement of studies	February 2023		Academic year of realisation of subject		2023/2024		
Education level	second-cycle studies		Subject group		Obligatory subject group in the field of study 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		2.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department of Colloid and Lipid Science -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Adam Macierzanka				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	0.0	30
	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	30		2.0		18.0	50
Subject objectives	The aim of the course is to provide a broad but detailed introduction to chemistry and technology of colloids and an overview of some theoretical developments, up-to-date experimental advances and current industrial applications, with an emphasis on colloid chemistry for building and construction industries.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K7_W03		a broader and deeper knowledge of structural properties of colloidal systems		[SW1] Assessment of factual knowledge		
	K7_K04		is aware of the importance of creative thinking in entrepreneurship		[SK5] Assessment of ability to solve problems that arise in practice [SK4] Assessment of communication skills, including language correctness [SK3] Assessment of ability to organize work		
	K7_U07		is able to properly select a research method to determine selected properties of materials with colloidal structure; knows the possibilities and limitations of these methods		[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information		
	K7_W06		has knowledge of the use of advanced methods for testing the structure and properties of engineering materials, especially colloidal systems in construction industries; use of specialized scientific and research equipment to assess the effectiveness of technological processes and the impact of working conditions		[SW1] Assessment of factual knowledge		

## Subject contents

The science of dispersed systems is applicable in many industries; in the production of pharmaceutical, food, cosmetics or paints, as well as in polymer production technologies or the production of construction/building materials in construction chemistry.

The course will provide a general introduction to the chemistry and technology of dispersed systems coupled with a more detailed illustration of the most important theoretical and experimental aspects. It will also provide students with a comprehensive look at emerging technologies in this field; especially in colloid science for construction industries

The lectures will focus on the theories used in colloid science, their applications and associated measuring techniques. Topics that will be covered are divided in two sections and include:

1. 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:
  - Emulsion stability (flocculation and mechanisms of its formation, coalescence, phase inversion etc.),
  - Stability of foams and gels (phase migration, syneresis etc.),
  - Particle size determination techniques,
  - Measuring techniques for stability assessment of dispersed systems.
- Association colloids (micellization, micelle structure, liposomes, solubilisation etc.),
- Overview of conventional and modern microscopy methods in monitoring structural properties of

	<p>dispersed systems.</p> <p>The information presented to students in this part will focus on techniques used in preparation of various dispersions and evaluation of their functional properties. Only necessary fundamental knowledge relevant to the above aspects will be discussed. This is in order to avoid delivering basic theoretical knowledge that has already been presented to the students in the Physical Chemistry class.</p> <p>2. Industrial and scientific applications of dispersed systems and their importance in nano- and green technologies. These will include (but not be limited to) aspects such as:</p> <ul style="list-style-type: none"> <li>- Modern methods/equipment in characterising physical-chemical properties of dispersed systems,</li> <li>- Emulsion polymerisation,</li> <li>- Nano-engineering of paints and other coatings,</li> <li>- The use of building materials with colloidal structure.</li> </ul> <p>The theoretical knowledge gained by students will be finally evaluated in a written examination.</p>								
Prerequisites and co-requisites	Basic knowledge of physical chemistry and physics.								
Assessment methods and criteria	<table border="1"> <thead> <tr> <th>Subject passing criteria</th> <th>Passing threshold</th> <th>Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td>Lecture (written examination)</td> <td>50.0%</td> <td>100.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Lecture (written examination)	50.0%	100.0%
Subject passing criteria	Passing threshold	Percentage of the final grade							
Lecture (written examination)	50.0%	100.0%							
Recommended reading	Basic literature	I.D. Morrison, <i>Colloidal dispersions</i> , Wiley 2002; J. Sjoblom, <i>Emulsions and emulsion stability</i> , CRC Press 2006; B.P. Binks, <i>Modern aspects of emulsion science</i> , RCS 1998; 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; P. Ghosh, <i>Colloid and interface science</i> , PHI Learning Private Ltd., New Delhi, 2009; <a href="#">E.S. Hedges</a> , <i>Colloids</i> , Hedges Press, 2007; <i>Recent review articles in relevant scientific journals</i> .							
	Supplementary literature	C.E. Stauffer, <i>Emulgatory</i> , WNT, Warszawa 2001; H. Sonntag, <i>Koloidy</i> , PWN, 1982; E.T. Dutkiewicz, <i>Fizykochemia powierzchni</i> , WNT, Warszawa 1998; R. Zieliński, <i>Surfaktanty</i> , WAEP, Poznań 2000; G. Schramm, <i>Reologia – podstawy i zastosowania</i> , OWN, Poznań 1998; P. W. Atkins, <i>Podstawy chemii fizycznej</i> , PWN, Warszawa 1999; H. Buchowski, W. Ufnalski, <i>Roztwory</i> , WNT, Warszawa 1995.							
	eResources addresses	Adresy na platformie eNauczanie:							
Example issues/ example questions/ tasks being completed	Those will be directly related to the topics described above in the 'Class structure' section.								
Work placement	Not applicable								