

FACULTY OF CHEMISTRY

SUBJECT CARD

Name of subject in Polish: Surfaktanty specjalistyczne i układy zdyspergowane
 Name of subject in English: Specialty surfactants and dispersed systems
 Main field of study (if applicable): Chemical technology
 Specialization (if applicable): Technology of fine chemicals
 Profile: academic
 Level and form of studies: 2 level, full-time
 Kind of subject: obligatory
 Subject code: TCC024027
 Group of courses: NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30		30		
Number of hours of total student workload (CNPS)	90		90		
Form of crediting	Examination		crediting with grade		
For group of courses mark final course with (X)	X				
Number of ECTS points	3		3		
including number of ECTS points for practical (P) classes			3		
including number of ECTS points for direct teacher-student contact (BK) classes	1		1		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. English proficiency at level B2.
2. Principles of organic, inorganic and physical chemistry at the Ist level studies.
3. Basic laboratory skills: use of laboratory apparatus and volumetric glassware, preparation of solutions.

SUBJECT OBJECTIVES

- C1. Gaining knowledge on chemical and physical properties of specialty surfactants and dispersed systems.
- C2. Familiarizing with classification and performance properties of surfactants including the fine chemical products.
- C3. Gaining of knowledge on the synthesis methods of specialty surfactants.
- C4. Gaining of knowledge on fabrication technologies of dispersed systems, their physicochemical characterization and stability.
- C5. Broadening of knowledge concerning influence of surfactants on phenomena at the interface.
- C6. Gaining knowledge on the physicochemical and performance properties of the dispersed systems.
- C7. Gaining new knowledge on achievements in fabrication and physicochemical characterization of specialty surfactants.
- C8. Gaining practical skills on research on the properties of surfactants and emulsion-type dispersions.

SUBJECT LEARNING OUTCOMES

relating to knowledge:

PEK_W01 - Can define the dispersed systems, which are used in many fields of novel chemical technology.

PEK_W02 - Has knowledge about the structure and classification of specialty surfactants used in technology of dispersed systems.
PEK_W03 - Has knowledge on the basics of technological process design to obtaining the emulsion formulations with specific utilities.
PEK_W04 - Has knowledge on physicochemical methods for testing the stability and performance of the dispersed systems
PEK_W05 - Knows the basis for the assessment and analysis of phenomena occurring at the interface, with particular emphasis on adsorption processes, reduce surface tension and detergency.
PEK_W06 - Understands the issues describing kinetic, electrochemical and optical properties of the dispersed systems
PEK_W07 - Knows examples of the novel industry technologies utilizing the dispersions and colloids
relating to skills:
PEK_K01 - Can plan, conduct and control preparation of chemically and physically stable dispersions with the desired properties and morphology.
PEK_K02 - Can evaluate the basic parameters of physico-chemical processes of aggregation, running at interfaces.
PEK_K03 - Can determine the key performance properties of surfactants.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Lec 1	Classification and application of surfactants. General issues.	2
Lec 2	Synthesis and characteristic features of specialty surfactants – anionic surfactants.	2
Lec 3	Synthesis and characteristic features of specialty surfactants – cationic and nonionic surfactants.	2
Lec 4	Surface phenomena at interfaces – surface tension and interfacial adsorption.	2
Lec 5	Self-assembly behaviour of surfactants – micellization, critical micelle concentration.	2
Lec 6	Performance properties of specialty surfactants – wettability and foaming.	2
Lec 7	Performance properties of specialty surfactants – detergency.	2
Lec 8	Performance properties of specialty surfactants – solubilization and its use in drug delivery systems.	2
Lec 9	Emulsions – physicochemistry, technology and applications.	2
Lec 10	The use of emulsions in cosmetics. Multiple emulsions.	2
Lec 11	Microemulsion – physicochemistry, technology and applications.	2
Lec 12	Nanoemulsions – physicochemistry, technology and applications.	2
Lec 13	Liposomes – physicochemistry, technology and applications.	2
Lec 14	Templating processes.	2
Lec 15	Application of dispersed systems in industry.	2

	Total hours	30
Form of classes - laboratory		Number of hours
Lab 1	Introduction. Presentation of laboratory room. Acquaintance with health and safety (HS) regulations. Division into groups.	2
Lab 2	Emulsions - preparation and stability.	4
Lab 3	Microemulsions – construction of a pseudoternary-phase diagram.	4
Lab 4	Determination of the critical micelle concentration (CMC) value for ionic surfactants.	4
Lab 5	Foaming and wettability of surfactants.	4
Lab 6	Determination of solubilization capability of a model hydrophobic compound in micelles formed by selected surfactants.	4
Lab 7	Determination of the turbidity temperature and Krafft point for surfactants.	4
Lab 8	Determination of the molar mass of an amphipathic block copolymer.	4
	Total hours	30
TEACHING TOOLS USED		
N1. Lecture with multimedia presentation. N2. Examination with multiple choice test. N3. Simple experiments for individual preparation of the dispersion and the measurement of their physicochemical properties, performed in the prepared to this purpose teaching laboratory. N4. Elaboration of results of the conducted experiments in the form of a written report. N5. Written or oral test of knowledge regarding carried out experiments		
EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation (F – forming (during semester), P – concluding (at semester end))	Learning outcomes number	Way of evaluating learning outcomes achievement
P1 (lecture)	PEK_W01 – PEK_W06	Final examination
F1-7 (laboratory)	PEK_U01, PEK_U02	Oral or written evaluation of the theoretical preparation for laboratory classes (7 marks)
F8-14 (laboratory)	PEK_U01 –PEK_U02	Evaluation of the report from the performed experiments (7 experiments)
P2 (laboratory) = 2/3((F1+F7)/7)+1/3((F8+F14)/7)		
PRIMARY AND SECONDARY LITERATURE		
PRIMARY LITERATURE:		
[1] Clarence A. Miller, P. Neogi, <i>Interfacial phenomena equilibrium and dynamic effects</i> (second edition), CRC Press Taylor & Francis Group (2008) [2] Milton J. Rosen, <i>Surfactants and interfacial phenomena</i> (third edition), A John Wiley & Sons, Inc., Publication (2004)		

- [3] F.E. Friedli, *Detergency of specialty surfactants*, Marcel Dekker (2001)
[4] Abraham Aserin, *Multiple emulsions*, A John Wiley & Sons, Inc., Publication (2007)
[5] M. Fanun, *Microemulsions properties and applications*, CRC Press Taylor & Francis Group (2009)

SECONDARY LITERATURE:

- [1] M. L. Robins, *Micellization, Solubilization and Microemulsion*, Plenum Press, New York, (1977), 2, 713
[2] J.L. Salager, *Interfacial Phenomena in Dispersed Systems*, Laboratorio FIRP, Universidad de Los Andes (1993)

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

Dr hab inż. Urszula Bazylińska, prof. uczelni (urszula.bazylinska@pwr.edu.pl)

Dr inż. Agata Pucek (agata.pucek@pwr.edu.pl)