Zachodniopomorski Uniwersytet Technologiczny w Szczecinie

## Faculty of Chemical Technology and Engineering

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|---|---|---|---|
| *Field of study* | Chemical Engineering | | |
| *Mode of study* | stationary | *Level* | first cycle |
| *Graduate's qualification* | inżynier | | |
| *Area(s) of study* | nauki techniczne | | |
| *Educational profile* | general academic | | |
| *Module* | | | |
| *Course unit* | **Colloid and Surfactant Science** | | |
| *Code* | ChEn_1A_S_C20 | | |
| *Field of specialisation* | | | |
| *Administering faculty* | Institute of Organic Chemical Technology | | |
| *ECTS* | 5,0 | *ECTS (forms)* | 5,0 |
| *Form of course credit* | credits | *Language* | english |
| *Electives* | | *Elective group* | |

| *Form of instruction* | *Code* | *Semester* | *Hours* | *ECTS* | *Weight* | *Credit* |
|---|---|---|---|---|---|---|
| lecture | W | 6 | 15 | 2,0 | 0,50 | credits |
| laboratory course | L | 6 | 45 | 3,0 | 0,50 | credits |

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| *Leading teacher* | Janus Ewa (Ewa.Janus@zut.edu.pl) |
| *Other teachers* | Bartkowiak Marcin (Marcin.Bartkowiak@zut.edu.pl), Janus Ewa (Ewa.Janus@zut.edu.pl), Ossowicz Paula (Paula.Ossowicz@zut.edu.pl), Piegat Agnieszka (Agnieszka.Piegat@zut.edu.pl) |

| *Prerequisites* | |
|---|---|
| *W-1* | Chemistry |

| *Module/course unit objectives* | |
|---|---|
| *C-1* | Student has knowledge of the structure, characteristic features of surfactants and amphiphilic molecules, their properties, interfacial phenomena and colloidal systems with their participation |
| *C-2* | Student can determine the properties of surfactants and amphiphilic molecules; can characterize and measure the properties of colloids; can define and explain the observed phenomena |

| *Course content divided into various forms of instruction* | | *Number of hours* |
|---|---|---|
| *T-W-1* | Characteristic features of surfactans, classification and chemical structures of surfactants; criteria of application | 1 |
| *T-W-2* | Adsorption of surfactans at interfaces - surface tension, surface excess; interfacial tension, contact angle, wetting of surfaces and methods of measurements | 3 |
| *T-W-3* | Surfactant solubility; self-assembled surfactants aggregates - micelles and critical micelle concentration, factors affecting the CMC, structure of micelle and molecular packing; liquid crystalline mesophases; | 2 |
| *T-W-4* | Polymeric materials with self-assembly properties; amphiphilic polymers | 4 |
| *T-W-5* | Formation and stabilization of colloids: emulsions, microemulsions, foams, solid/liquid disperions; colloid stability, forms of instability, effect of surfactants and polymers on colloid stability | 4 |
| *T-W-6* | Colloids in products and processes | 1 |
| *T-L-1* | Determination of cloud points of nonionic surfactants. Effect of chemical structure on the cloud point. | 5 |
| *T-L-2* | Determination of the surface tension of surfactant solutions-effect of surfactants structure and additives. | 5 |
| *T-L-3* | Critical micelle concentration of surfactants - determination by surface tension and conductivity measurements | 5 |
| *T-L-4* | Determination of Krafft point and solubility of surfactants | 5 |
| *T-L-5* | Determination of required HLB for oil components and oil phase | 5 |
| *T-L-6* | Formation of emulsions and determination of their stability | 5 |
| *T-L-7* | Self assembly properties of polymeric materials. Determination of hydrodynamic radius of polymeric micelles. | 5 |
| *T-L-8* | Self assembly properties of polymeric materials. Determination of Zeta-potential of polymeric micelles. | 5 |
| *T-L-9* | Self assembly properties of polymeric materials. Determination of critical micelles concentration. | 5 |

| *Student workload - forms of activity* | | *Number of hours* |
|---|---|---|
| *A-W-1* | participation in lectures | 15 |
| *A-W-2* | individual study of literature | 45 |
| *A-L-1* | Preparation for labs | 14 |

| *Student workload - forms of activity* | | *Number of hours* |
|---|---|---|
| *A-L-2* | Perfoming experiments in laboratory | 45 |
| *A-L-3* | Analysis of the results of experiments and their interpretation | 18 |
| *A-L-4* | Lab report | 13 |

| *Teaching methods / tools* | |
|---|---|
| *M-1* | Laboratory |
| *M-2* | Lectures |
| *M-3* | Discussion |

| *Evaluation methods (F - progressive, P - final)* | | |
|---|---|---|
| *S-1* | F | lab report |
| *S-2* | F | continuous assessment |
| *S-3* | P | Written exam |

| Designed learning outcomes | Reference to the learning outcomes designed for the fields of study | Reference to the learning outcomes defined for the particular areas of education | Reference to learning outcomes leading to the degree of "inżynier" | Course objectives | Course content | Teaching methods | Evaluation methods |
|---|---|---|---|---|---|---|---|
| *Knowledge* | | | | | | | |
| ChEn_1A_C20_W01<br>Student can: describe structure and properties of surfactants and amphiphilic polymers; define and explain surface and interfacial phenomena and different types of colloidal systems; describe interactions between colloidal particles and explain colloidal stability and instability | ChEn_1A_W07<br>ChEn_1A_W08<br>ChEn_1A_W20 | P6S_WG_TA11 | | C-1 | T-W-1 T-W-4<br>T-W-2 T-W-5<br>T-W-3 T-W-6 | M-2<br>M-3 | S-3 |
| *Skills* | | | | | | | |
| ChEn_1A_C20_U01<br>Student can perform numeric calculations of physical-chemical quantities; provide a graphical representation of experimental data; evaluate experimental data in relation to relevant theory; use releveant theory to analyze practical problems | ChEn_1A_U01<br>ChEn_1A_U03<br>ChEn_1A_U05<br>ChEn_1A_U08<br>ChEn_1A_U10<br>ChEn_1A_U16 | P6S_UO<br>P6S_UU<br>P6S_UW_TA11<br>P6S_UW_TA13<br>P6S_UW_TA14 | P6S_UW_IA11<br>P6S_UW_IA14 | C-2 | T-L-1 T-L-6<br>T-L-2 T-L-7<br>T-L-3 T-L-8<br>T-L-4 T-L-9<br>T-L-5 | M-1 | S-1<br>S-2 |
| *Other social / personal competences* | | | | | | | |
| ChEn_1A_C20_K01<br>Student can cooperate in a group to perform experiments in lab at the alloted time; can reflect on the different solutions for a specific problem; express oneself in scientifically correct manner | ChEn_1A_K01<br>ChEn_1A_K03<br>ChEn_1A_K04<br>ChEn_1A_K05 | P6S_KK<br>P6S_KO<br>P6S_KR | | C-1<br>C-2 | T-L-1 T-L-9<br>T-L-2 T-W-1<br>T-L-3 T-W-2<br>T-L-4 T-W-3<br>T-L-5 T-W-4<br>T-L-6 T-W-5<br>T-L-7 T-W-6<br>T-L-8 | M-1<br>M-2<br>M-3 | S-1<br>S-2<br>S-3 |

| *Required reading* |
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| 1. R. J. Farn (Ed.), Chemistry and Technology of Surfactants, Blackwell Publishing, 2006 |
| 2. M. R. Potter, Handbook of surfactants, Springer Science + Business Media, 1993, Chapter 4 |
| 3. European standards |
| 4. Milton J. Rosen, Joy T. Kunjappu, Surfactants and Interfacial Phenomena, WILEY, 2012, 4th Edition |
| 5. Krister Holmberg, Bo Jonsson, Bengt Kronberg and Bjorn Lindman, Surfactants and Polymers in Aqueous Solution, John Wiley & Sons, Ltd., 2002, 2nd ed. |
| 6. Terence Cosgrove, Colloid Science Principles, methods and applications, WILEY, 2010, 2nd ed. |