

Course code	IRL109		
Course title	COLLOIDS		
General information			
Study programme	Graduate study „Drug research and development“, Graduate study „Biotechnology in medicine“, Graduate study „Medical chemistry“	Academic year	3
Lecturer	Doc. Dr. Sc. Duško Čakara		
Status	Required	Elective	
ECTS system			3
Course objectives			
Introduction to the physical chemistry of colloids and interfaces. Clarification of the macroscopic, mesoscopic and microscopic properties of macromolecules in solution, colloidal dispersions, discontinuous phases, films and membranes, based on chemical thermodynamics. To provide a comprehensive yet understandable overview of both classical and advanced experimental techniques for the physico-chemical characterization of the above systems. To apply the newly acquired knowledge for an independent and creative solving of calculation and theoretical problems in the fields of formulation of drugs and cosmetic products.			
Course description			
A repetitory of mathematical and physico-chemical terms			
Statistical distributions – Gauss, log-normal. Boltzmann distribution and its application in chemical thermodynamics. Poisson equation. Decay functions. Chemical potential and the standard chemical potential. Chemical potential of molecules at phase boundaries. Electric double layer at phase boundaries.			
Solutions			
Polarity of molecules. Hydrophiles and lipophiles. Relation between the solubility and the acid-base equilibria. Partition coefficient. Electrochemical and spectroscopic measurements.			
Macromolecules			
Size and shape parameters of macromolecules. Random walk. Brownian motion. Diffusion coefficient. Einstein formula. Viscosity. Stokes law. Macromolecules in solution – the role of the solvent. Polyelectrolytes. Protonation equilibrium in macromolecules. The role of the counterions. Manning theory. The charge of proteins. Isoelectric point. Hofmeister series. Charge-conformation coupling. Electrokinetic measurements.			
Colloids and discontinuous phases			
Adsorption of molecules at phase boundaries. Adsorption isotherms. Surface tension and its determination. Adhesion. Amphiphiles. Micelles. Critical micellization concentration. Packing of amphiphiles. Bilayers of amphiphiles. Vesicles. Membranes. Phase diagrams of discontinuous phases. Emulsions. Nanoparticles. Electrostatic and Van der Waals interactions. Colloidal stability – DLVO theory. Colloidal crystals. Gels. Optical measurements – light scattering.			
Learning outcomes			
Knowledge of the physico-chemical fundamentals of colloids and interfaces.			
Understanding the relations between the micro-, meso-, and macroscopic properties of the above systems.			
Independent and creative problem solving in relation to the course substance.			