Description of an Individual Course Unit

Study program	All, except Chemistry		
Module			
Type and level of studies	PhD studies		
Course title	Advanced Chemical Engineering Thermodynamics		
Professor (for lectures)	Slobodan Šerbanović, Mirjana Kijevčanin		
Professor/assistant (for practice)			
Professor/assistant (for LAB)			
Number of ECTS	5	**Type of the course (mandatory/elective)**	Elective
Prerequisit	-		
Objective of the course	The aim of the course is to make adequate relations between molecular and classical thermodynamics, using the results obtained by the statistical thermodynamic. In order to have appropriate description of the solution behavior, selection of a theoretical model will be described Phase equilibria, relevant to the chemical, polymer, pharmaceutical and biochemical engineering and ecology will be modeled.		
Learning outcomes of the course	After this course students will be able: (1) to analyze complex thermodynamic process, (2) to solve thermodynamic problems using several/different types of approaches (classical and molecular), (3) to adapt projects to new or modified thermodynamic conditions (4) to gain competencies and skills needed to work in scientific research team.		
Course Contents			
Course Contents	• Introduction to statistical thermodynamics. Intermolecular forces. Molecular theory. ; • The fugacity of gaseous mixtures (virial coefficients and potentials). Fugacity of the liquid mixture (Excess functions for binary and multicomponent mixtures Wilson, NRTL, UNIQUAC equation). Excess functions and partial miscibility. Predicting of the activity coefficients: UNIFAC equation. ; • Models and theories of the solution (van Laar, Scatchard-Hildebrand theory, two-fluid theory, etc). ; • Polymers: Flory-Huggins theory; equation of state for polymer solutions (Prigogine-Flory-Patterson theory). ; • Thermodynamics of emulsions (thermodynamic theory of emulsions formation and their stability). ; • Solubility of gases and solids in liquids. ; • Phase equilibria at high pressure (liquid-liquid equilibria, the gas-liquid equilibria, phase equilibria calculation using equations of state, equilibrium phase calculation using chemical theory). ; • Molecular simulation. ;		
Practical part (practices, LAB, study research work)	Computer simulations and lab class that follow the theoretical classes.		
Literature			
1	B. Đorđević, M. Kijevčanin, S. Šerbanović, I.Radović: Hemijsko-inženjerska termodinamika (texbook is under preparation)		
2	Prausnitz, J.M., Lichtenthaler, R.N., de Azevedo, E.G. Molecular Thermodynamics of Fluid-Phase Equilibria, 3rd ed., Prentice Hall, New Jersey, 1998		
3	Poling, B.E., Prausnitz, J.M., O'Connell, J.P., The Properties of Gases and Liquids, 5th ed., McGraw-Hill, New York, 2001		
4			
5			

Lessons per week				
Lectures	**Practices**	**LAB**	**Study research work**	**Other activities**
2				

Teaching Methods	Theoretical and practical lectures.

Grading methods (max. number of points is 100)			
Pre-exam assesments	**points**	**Final examination**	**points**
class work	10	**written exam**	
test	40	**oral exam**	30
seminars	20		