	UNIVERSITY OF EAST SARAJEVO Faculty of Technology Zvornik	
	Study programme: *Chemical Engineering and Technology*	
	Cycle I / Year II	

Course title	**Chemical Thermodynamics**
Department	Department for Physical Chemistry, Electrochemical Engineering and Materials– Faculty of Technology Zvornik

Course code	**Course status**	**Semester**	**ECTS**
04-1-022-4	Compulsory	IV	4

Teacher	Dragan Tošković, PhD, full professor
Teaching assistant	Danijela Rajić, MSc, senior assistant

Number of classes/ teaching workload (per week)			**Individual student workload (in hours per semester)**			**Student workload coefficient S_o**
Lectures	**Auditory exercises**	**Laboratory exercises**	**Lectures**	**Auditory exercises**	**Laboratory exercises**	**S_o**
2	1	0	45	45	0	1.67
2*15+1*15+0*15=45 hours			(2*15*1.67+1*15*1.67+0*15*1.67)=75 hours			
Total course workload 45 + 67,5=112,5 hours per semester						

Learning outcomes	After finishing the course, students will be able to: 1. demonstrate and utilize knowledge about single- and multi-component systems and the processes that take place in them 2. demonstrate and utilize knowledge about single- and multiphase systems, and the processes that take place in them, which are necessary for defining basic practical problems in chemical engineering calculations. 3. demonstrate and utilize basic knowledge about thermodynamic quantities used to describe pure substances and their mixtures: gaseous phase, liquid mixtures, phase balance. 4. master the most important engineering equations for correlating and predicting thermodynamic quantities of pure substances, simple and complex mixtures characterized by non-polar, weakly polar and polar substances, asymmetric mixtures with associates and solvates 5. independently solve problems in the field of chemical thermodynamics understanding its place and importance for other technical and technological disciplines within the curriculum.
Prerequisites	
Teaching methods	Lectures, auditory and laboratory exercises, mid-term tests (colloquia).
Syllabus outline per week	1. Basic principles: Thermodynamic systems. State of the system and thermodynamic quantities of the state. 2. Homogeneous systems: Thermodynamic model of an ideal gas. Auxiliary thermodynamic functions that describe the deviation of the real fluid from the ideal gas model. 3. Compressibility factor. Residual thermodynamic quantities. Fugacity and fugacity coefficient. Calculation of fugacity from P v T data. 4. Homogeneous system of constant composition: Calculation of thermodynamic functions by integration of the total differential. 5. One-component heterogeneous system: Phase equilibrium condition. Relationship between temperature and pressure of a two-phase system. Correlation of vapor pressure and temperature. 6. Evaluation of P v T and thermodynamic characteristics of fluids: Principle of corresponding states. 7. Virial equation of state. Application to mixtures. Cubic equations of state. RK and SRK equations of state 8. Knowledge check (Mid-term test (Colloquium) I,...) 9. Homogeneous systems of variable composition: Fugacity and coefficient of fugacity of components. Changes in thermodynamic properties during mixing. Henry's Law. Activity and activity coefficient. 10. Thermal effects: Thermal effects of chemical reactions. Thermal effects in mixing processes. 11. Phase balance: General condition of phase balance. Ideal balance at low pressures. Non-ideal behavior of the liquid phase. 12. Reaction equilibrium: Degree of progress of the reaction - reaction coordinate. Reaction fluid - gas.

	Heterogeneous solid phase reactions. Calculation of equilibrium composition. 13. Multireaction straight line: Number of independent chemical reactions. Finding the equilibrium composition in a multi-reaction equilibrium. Minimizing the Gibbs function. 14. Stationary flow reactor: Material and energy balance of a stationary flow reactor. 15. Knowledge test (Mid-term test (Colloquium) II,...) Mid-term tests are taken after the 8th week and the 15th week. Semester verification is required after the 15th week.

Obligatory reading			
Author	**Title, publisher**	**Year**	**Pages**
Zavargo, Z., Paunović, N.	Basics of chemical thermodynamics, Faculty of Technology, Novi Sad,	1997	

Additional reading			
Author	**Title, publisher**	**Year**	**Pages**
Radovanović, D i dr.	Chemical - engineering thermodynamics - Manual Faculty of Technology and Metallurgy, Belgrade	1981	
Đorđević, B.	Chemical - engineering thermodynamics Faculty of Technology and Metallurgy, Belgrade	1978	
Radojković, N., Cvetković, R., Stamenković, I.	Chemical engineering thermodynamics collection of tasks, University of Niš	2004	
Smith, J., Van Ness, H., Abbott, M.	Introduction to Chemical Engineering Thermodynamics, Mcraw-Hill, New York.	2005	

	Type of student evaluation	**Graqde points**	**Percentage**
Obligations, assessment methods and grading system	Pre-exam obligations		
	Attendance	6	6%
	Seminar	16	16 %
	Mid-term test (Colloquium) I	24	24 %
	Mid-term test (Colloquium) II	24	24 %
	Final examination		
	Final examination (oral)	30	30 %
	Total	100	100 %
Webpage	www.tfzv.ues.rs.ba		
Date	2023		