Faculty of Metalurgy and Technology / METALLURGY AND MATERIALS / THERMODINAMICS OF MATERIALS

Course:	THERMODINAMICS OF MATERIALS			
Course ID	**Course status**	**Semester**	**ECTS credits**	**Lessons** (Lessons+Exercises+Laboratory)
2987	Mandatory	2	6	3+2+0
Programs	METALLURGY AND MATERIALS			
Prerequisites	No prerequisites			
Aims	To introduce students with a basic knowledge of thermodynamics of materials, a science that studies macroscopic states and energy transformations during various physico-chemical processes, in order to more easily master theoretical and practical problems in the field of materials in the further course of studies.			
Learning outcomes	After passing the exam, the student will be able to: - Defines basic thermodynamic concepts, quantities of state and process and equation of state and interprets thermodynamic laws; - It defines the conditions of the process and the balance criteria - Interprets the thermodynamic bases of ideal and real solutions, Raults and Henrys law - Interprets the thermodynamic basis of crystal structure defects - Defines the concept of heterogeneous reactions, reaction rate and diffusion rate.			
Lecturer / Teaching assistant	Prof. Irena Nikolić , PhD			
Methodology	Lectures, exercises (calculation), preparation of homework. Consultations			
Plan and program of work				
Preparing week	Preparation and registration of the semester			
I week lectures	Basic thermodynamic terms. The system. Energy. State and process quantities. Equation of state.			
I week exercises	Calculation: gas laws			
II week lectures	The first law of thermodynamics. Heat and work. Internal energy. Enthalpy. Balance equations.			
II week exercises	Calculations: first law of thermodynamics. Heat and work. Internal energy. Enthalpies. Balance equations			
III week lectures	The second law of thermodynamics. Entropy as a quantity of state.			
III week exercises	Calculation: the second law of thermodynamics. Entropy.			
IV week lectures	Auxiliary thermodynamic functions. The third law of thermodynamics. Partial molar sizes.			
IV week exercises	Calculation: The third law of thermodynamics and auxiliary thermodynamic functions.			
V week lectures	Balance criteria. Equilibrium conditions.			
V week exercises	Calculation: Chemical potential. Conditions for the process. Equilibrium criteria. Equilibrium conditions.			
VI week lectures	Equilibrium constant. Change in equilibrium constant with temperature. Ellingham diagrams.			
VI week exercises	Calculation: Equilibrium constant. Changes in the equilibrium constant with temperature. Ellingham diagrams.			
VII week lectures	First midterm exam			
VII week exercises	Correctional first midterm exam			
VIII week lectures	Thermodynamics of solutions. Ideal and real solutions.			
VIII week exercises	Calculation: Thermodynamics of solutions. Ideal and real solutions.			
IX week lectures	Thermodynamic quantities of solutions. Methods of determining activity. Regular solutions.			
IX week exercises	Calculation: thermodynamic quantities of solutions. Activity determination methods and regular solutions			
X week lectures	Thermodynamic basis of phase diagrams. Determination of activity based on phase diagrams.			
X week exercises	Determination of activity based on phase diagrams.			
XI week lectures	Thermodynamics of defects. Types of defects. Defects in compounds. Wagners theory of oxidation.			
XI week exercises	Calculation: thermodynamics of defects.			
XII week lectures	Statistical thermodynamics. Macro states and micro states. Boltzmanns hypothesis.			
XII week exercises	Calculation: statistical thermodynamics			

XIII week lectures	Kinetics of heterogeneous reactions. Phenomena in heterogeneous reactions. Rate of reaction and diffusion.
XIII week exercises	Calculation: kinetics of heterogeneous reactions.
XIV week lectures	Application of the general laws of kinetics of reactions in the solid state.
XIV week exercises	Calculation: Application of the general laws of kinetics of reactions in the solid state.
XV week lectures	Second midterm exam
XV week exercises	Correctional second midterm exam
Student workload	Weekly: 6 ECTS x 40/30 hours = 6 hours 40 min Total workload for the semester = 150 hours

Per week	Per semester
6 credits x 40/30=8 hours and 0 minuts 3 sat(a) theoretical classes 0 sat(a) practical classes 2 excercises **3 hour(s) i 0 minuts** of independent work, including consultations	Classes and final exam: **8 hour(s) i 0 minuts x 16 =128 hour(s) i 0 minuts** Necessary preparation before the beginning of the semester (administration, registration, certification): **8 hour(s) i 0 minuts x 2 =16 hour(s) i 0 minuts** Total workload for the subject: **6 x 30=180 hour(s)** Additional work for exam preparation in the preparing exam period, including taking the remedial exam from 0 to 30 hours (remaining time from the first two items to the total load for the item) **36 hour(s) i 0 minuts** Workload structure: **128 hour(s) i 0 minuts (cources), 16 hour(s) i 0 minuts (preparation), 36 hour(s) i 0 minuts (additional work)**
Student obligations	Attending classes, passing the midterm the final exams
Consultations	Working days 10-11 h.
Literature	Ž. Živković: Principi metalurške termodinamike, TF Bor 1997; D. Blečić: Teorija metalurških procesa(I dio), Unireks Nikšiđ 1994; D. Ragone: Thermodinamics of Materials, John Wiley, New York 1995. Ž. Živković: Zbirka zadataka iz teorije metalurških procesa (I i II dio)TF Bor, 1994 i 2001.
Examination methods	ctivity during the lecture: (0 - 3 points), - Exercise activity: (0 - 3 points), - Correctly completed homework: (0 - 4 points), - I colloquium: (0 - 20 points), - II colloquium: (0 - 20 points), - Final exam: (0 - 50 points), The student gets the passing grade by collecting 50 points at least
Special remarks	
Comment	

Grade:	F	E	D	C	B	A
Number of points	less than 50 points	greater than or equal to 50 points and less than 60 points	greater than or equal to 60 points and less than 70 points	greater than or equal to 70 points and less than 80 points	greater than or equal to 80 points and less than 90 points	greater than or equal to 90 points