Faculty of Metalurgy and Technology / CHEMICAL TECHNOLOGY / POWDER PROCESSING

Course:	POWDER PROCESSING			
Course ID	**Course status**	**Semester**	**ECTS credits**	**Lessons** (Lessons+Exercises+Laboratory)
12232	Optional	3	6	2+1+1
Programs	CHEMICAL TECHNOLOGY			
Prerequisites	No mutual dependency			
Aims	the goals are oriented towards the knowledge adoption concerning the different concepts of powder production, characterization, densification as well as the final compaction and the characterization of compacts			
Learning outcomes	fter the completion of the course student should: 1. Differentiate the techniques for powder preparation in accordance of powders properties, 2. Be capable to analyze the results of powders characterization: size, size distribution, shape, porosity, macrostructure, density, 3. Be familiar with the theoretical fundamentals of different processes like densification by shaping and compaction, 4. Based on theoretical knowledge apply the consolidation without the binder and with binder 5. Identify technological problems in production, characterization and consolidation of powders and find the solution, 6. Be familiar with the theoretical aspects of sintering, 7. Be familiar with the techniques of final procession and characterization of compacted powder..			
Lecturer / Teaching assistant	Prof. dr Mira Vukčević			
Methodology	Lectures, practical and theoretical exercises, colloquia			
Plan and program of work				
Preparing week	Preparation and registration of the semester			
I week lectures	powder production, mechanical methods			
I week exercises	Relation between the powder properties and the processing technique. Milling and mechanical alloying as the most primitive processing techniques			
II week lectures	Powder production, physico-chemical method			
II week exercises	precipitation from the metal salt solution			
III week lectures	Powder production, atomization techniques			
III week exercises	the rotation electrode process, examples, visualization			
IV week lectures	Characterization of powders, size, size distribution, shape, porosity			
IV week exercises	Microscopy, sieving			
V week lectures	Densification by shaping			
V week exercises	casting, extrusion			
VI week lectures	Densification by compaction			
VI week exercises	Density of the compacts as the function of applied pressure			
VII week lectures	First colloquium			
VII week exercises	Practical aspects of conventional pressing, experiment, result analysis			
VIII week lectures	Low-temperature and High-energy compaction			
VIII week exercises	Rolling of the powders, laboratory, explosive compaction			
IX week lectures	sintering, theoretical aspects of material transport during the sintering process			
IX week exercises	Densification in sintering, detection of contacts, laboratory			
X week lectures	Solidus sintering process			
X week exercises	Forming of the contacts, contacts growth, microscopy			
XI week lectures	Liquidus sintering			
XI week exercises	Development of the microstructure, dissolution and rearrangement, densification			
XII week lectures	Specific sintering processes in the presence of liquid phase			
XII week exercises	Super-solidus sintering, transition liquid phase, microscopy			

XIII week lectures	High-temperature consolidation
XIII week exercises	Characteristics, deformation mechanism
XIV week lectures	Characterization of compacted materials
XIV week exercises	Characterization of surface, compressive strength, porosity
XV week lectures	2nd Colloquium
XV week exercises	Corrective 2nd. colloquium
Student workload	

Per week	**Per semester**
6 credits x 40/30=8 hours and 0 minuts 2 sat(a) theoretical classes 1 sat(a) practical classes 1 excercises **4 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	Active participation in the lectures, the exercises, colloquia, written exam
Consultations	Mondays and Fridays after 12 a.m
Literature	.M.Mitkov, D.Božić, Z. Vujović, Metalurgija praha, Naučna knjiga, Beograd 1998 2. R.German, Powder Metallurgy science, 2nd edition, 2005 3. R.German, Powder Metallurgy Science,3rd edition 2008
Examination methods	Active participation in lectures and exercises (0-10 points) Colloquia up to 20 points Final exam up to 50 points
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