Faculty of Mechanical Engineering / MECHANICAL ENGINEERING / METAL FORMING

Course:	METAL FORMING			
Course ID	**Course status**	**Semester**	**ECTS credits**	**Lessons** (Lessons+Exercises+Laboratory)
11100	Mandatory	6	5	3+1+1
Programs	MECHANICAL ENGINEERING			
Prerequisites	No conditions			
Aims	The subject aims to provide students with necessary engineering knowledge of the theoretical basis for metal forming, projecting of tchnologies, and machines, which are used in metal forming			
Learning outcomes	After the student has completed the exam will be able to: 1. Knows theoretical basis of strain, nominal and actual strains, strength curves, strain rates and velocity of deformation. 2. Knows the dependence of yield stress vs. significant factors. 3. Knows how to calculate the deformation force and deformation work. 4. Knows the theory of stress, strain theories and hypotheses about the plastic flow and their comparison. 5. Knows the rolling process, the theory of rolling, contact friction, the parameters of the deformation zone of rolling, medium pressure on the rollers, impacts on the process of rolling, spreading pieces during rolling, rolling torques. 6. Knows the processes of bulk forming, forging and upseting. 7. Knows forging processes such as stabbing and extrusion. 8. Knows the bulk forming in open dies. 9. Knows the processes of cutting, processes of bending and deep drawing processes. 10. Knows the structure, principles of operation and utilization of machinery for metal forming.			
Lecturer / Teaching assistant	Prof. dr Mileta Janjić			
Methodology	Lectures, exercises, laboratory exercises			
Plan and program of work				
Preparing week	Preparation and registration of the semester			
I week lectures	Basic settings of strain. Nominalni and real stress. The yield stress curves. The changes of mechanical properties. Strain rate and velocity of deformation.			
I week exercises	Determination of nominal and real stresses and strength curves.			
II week lectures	Dependence of the specific deformation resistance. Deformation forces and work. Contact friction.			
II week exercises	Determination of strain rate and velocity of deformation.			
III week lectures	Theory of stresses.			
III week exercises	Solving tasks from the theory of stresses.			
IV week lectures	The theory of strain. Hypotheses about the plastic flow and their comparison.			
IV week exercises	Solving tasks from the theory of strains.			
V week lectures	Rolling processes. The theory of rolling. Contact friction. Solutions of differential equations.			
V week exercises	Solving tasks with hypotheses about plastic flow.			
VI week lectures	The parameters of the deformation zone of rolling. Medium pressure on rollers. Impacts on the rolling process. Spreading pieces during rolling. Rolling torques.			
VI week exercises	Determination of the stresses in the zone of deformation, medium pressure to the rolls, spreading pieces during rolling and rolling torques.			
VII week lectures	I Colloquium.			
VII week exercises	I Colloquium.			
VIII week lectures	The processes of bulk forming.			
VIII week exercises	Solving tasks of bulk metal forming processes.			
IX week lectures	Forging. Upsetting.			
IX week exercises	Solving tasks of forging and upsetting.			
X week lectures	The stabbing. Extrusion. Bulk metal forming in open dies.			
X week exercises	Solving the tasks of stabbing the extrusion.			
XI week lectures	The process of cutting.			
XI week exercises	Solving the tasks of bulk forming in open dies.			

XII week lectures	The bending process.
XII week exercises	Solving the tasks of cutting metal.
XIII week lectures	Deep drawing processes.
XIII week exercises	Solving tasks in bending.
XIV week lectures	Machines for metal forming.
XIV week exercises	Solving tasks in deep drawing. Determination of the required characteristics of machines for metal forming.
XV week lectures	II Colloquium.
XV week exercises	II Colloquium.
Student workload	

Per week	**Per semester**
5 credits x 40/30=6 hours and 40 minuts 3 sat(a) theoretical classes 1 sat(a) practical classes 1 excercises **1 hour(s) i 40 minuts** of independent work, including consultations	Classes and final exam: **6 hour(s) i 40 minuts x 16 =106 hour(s) i 40 minuts** Necessary preparation before the beginning of the semester (administration, registration, certification): **6 hour(s) i 40 minuts x 2 =13 hour(s) i 20 minuts** Total workload for the subject: **5 x 30=150 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) **30 hour(s) i 0 minuts** Workload structure: **106 hour(s) i 40 minuts (cources), 13 hour(s) i 20 minuts (preparation), 30 hour(s) i 0 minuts (additional work)**
Student obligations	Students are required to attend lectures, exercises, do project tasks and colloquiums.
Consultations	On the day of classes, after classes.
Literature	• B. Musafija: Primijenjena teorija plastičnosti, I dio. Univerzitet u Sarajevu, Sarajevo, 1973. • B. Musafija: Obrada metala plastičnom deformacijom. Svjetlost, Sarajevo, 1972. • M. Čaušević: Obrada metala valjanjem. "Veselin Masleša", Sarajevo, 1983. • M. Janjić: Istraživanje naponsko deformacionih parametara u procesima zapreminskog deformisanja. Univerzitet Crne Gore - Mašinski fakultet, Podgorica, 2008.
Examination methods	• Attendance - 4 points; • Four project tasks of 4 points each - 16 points; • Two colloquiums with 20 points each - 40 points; • Final exam - 40 points. • A passing grade is obtained if at least 50 points are accumulated cumulatively.
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