Faculty of Mechanical Engineering / MECHATRONICS / MACHINE ELEMENTS I

Course:	MACHINE ELEMENTS I			
Course ID	**Course status**	**Semester**	**ECTS credits**	**Lessons** (Lessons+Exercises+Laboratory)
1610	Mandatory	3	5	3+2+0
Programs	MECHATRONICS			
Prerequisites	Passed subject Statics			
Aims	In this subject is taught calculation and shaping machine elements, with special emphasis on the shaft and the axle. In this subject is taught the calculation the most important mechanical joints.			
Learning outcomes	Upon completion of this course the student will be able to: 1. commit the selection of the size and position of the tolerance zone, as well as to analyze the impact of temperature changes on change selected seating 2. determine the working and critical loads of machine elements based on which can calculate the level of security 3. commit estimate the shafts and axle by the criteria of firmness, rigidity and dynamic stability 4. commit estimate moveless threaded joints (longitudinally and transversely loaded bolted connections), as well as the calculate moving threaded joints 5. commit estimate pressed, groove and toothed connection, as well as a selection of wedges without slope, wedges with a slope, tangent wedges and sectional wedges 6. commit a choice and estimate the axles and pin 7. commit estimate flexion springs, simple torsion springs, helical torsion springs, belleville springs, ring springs and rubber springs			
Lecturer / Teaching assistant	Prof. dr Radoslav Tomović			
Methodology	Lectures, exercises, homeworks, colloquiums and laboratory exercises			
Plan and program of work				
Preparing week	Preparation and registration of the semester			
I week lectures	Design. Introduction. Definition. Design process. Design with aspect of production. Design with aspect of recycling. Design with aspect of aesthetics and ergonomics. Computer aided design.			
I week exercises	Design process.			
II week lectures	Standard numbers and tolerance of machine parts. Standardization. Tolerances of linear of measures. ISO- system tolerances of linear of measures. Complex tolerances. Temperature influence on tolerances. Tolerances shape and positions. Tolerances roughness			
II week exercises	Tolerances of linear of measures. ISO- system tolerances of linear of measures. Complex tolerances. Temperature influence on tolerances. Homework.			
III week lectures	Basics calculate of machine elements. Introduction. Calculation method of bearing capacity of machine elements. Working loads of machine elements. Working stresses. The stress concentration. The surface tension.			
III week exercises	Working loads of machine elements. Working stresses. The stress concentration. The surface tension.			
IV week lectures	Critical loads of machine elements. Static firmness of machine parts. The dynamic firmness of machine parts. Influence changes loads on dynamic firmness of machine parts. Level of security and allowed stress. Material for production machine parts.			
IV week exercises	Critical loads of machine elements. Static firmness of machine parts. The dynamic firmness of machine parts. Influence changes loads on dynamic firmness of machine parts. Level of security and allowed stress.			
V week lectures	Shafts and axle. Introduction. Task and division. Material for shafts. Production shafts. Loads shafts. Static analysis loads. Resistances of supports. Attackly loads of shafts and axles.			
V week exercises	Loads shafts. Static analysis loads. Resistances of supports. Attackly loads of shafts and axles.			
VI week lectures	The calculation shafts and axle by the criteria of firmness.			
VI week exercises	The calculation shafts and axle by the criteria of firmness. Homework.			
VII week lectures	The calculation shafts and axle by the criteria of rigidity. The calculation shafts and axle by the criteria of dynamic stability.			
VII week exercises	I Colloquium			
VIII week lectures	Threaded fasteners. Introduction. The parameters thread. Joint threaded. Standard thread profiles. Materials for production threaded parts. Production and protection threaded parts. Kinematics. Loads and tension couples with threaded.			
VIII week exercises	The parameters thread. Joint threaded. Standard thread profiles. Kinematics. Loads and tension			

	couples with threaded.
IX week lectures	Longitudinal load bolts connection. Tightening bolts connections. Rigidity bolts and rigidity connected parts. Working load bolts connections (static and dynamic). The influence of the force position on bolts connection. Measures to ensure bolts connectio
IX week exercises	Longitudinal load bolts connection. Tightening bolts connections. Rigidity bolts and rigidity connected parts. Working load bolts connections (static and dynamic). The influence of the force position on bolts connection. Measures to ensure bolts connectio
X week lectures	Transversely load bolted connections. Unregulated (friction) bolted connection. The adjusted (shear) bolted connection. Group bolted connections.
X week exercises	Transversely load bolted connections. Unregulated (friction) bolted connection. The adjusted (shear) bolted connection. Group bolted connections. Homework.
XI week lectures	Moving threaded joints. Load and tension moving threaded joints. Degree of efficiency moving threaded joints. The check firmness threaded spindle.
XI week exercises	Moving threaded joints. Load and tension moving threaded joints. Degree of efficiency moving threaded joints. The check firmness threaded spindle.
XII week lectures	Shaft connections and working parts. Torque transmission via of resistance slip. Compounds by using two-piece hub. Compounds by using cuted hub. The compounds form contact surfaces. Conical clamp connections. The groove connections. The toothed connection
XII week exercises	Shaft connections and working parts. Torque transmission via of resistance slip. Compounds by using two-piece hub. Compounds by using cuted hub. The compounds form contact surfaces. Conical clamp connections. The groove connections. The toothed connection
XIII week lectures	The axles and linchpin. The calculations and sizing the axles. Check load joints. The calculations linchpin.
XIII week exercises	The axles and linchpin. The calculations and sizing the axles. Check load joints. The calculations linchpin.
XIV week lectures	Springs. Introduction. Spring characteristics. Springs sistems. Materials. Flexion springs. Leaf springs. Helical flexion springs. Spiral springs. Torsion springs (unladylike springs and helical springs). Belleville springs. Rubber springs.
XIV week exercises	Flexion springs. Leaf springs. Helical flexion springs. Spiral springs. Homework.
XV week lectures	II Colloquium
XV week exercises	Torsion springs (unladylike springs and helical springs). Belleville springs. Rubber springs.
Student workload	3 hours of lectures and 3 hours exercises

Per week	**Per semester**
5 credits x 40/30=6 hours and 40 minuts 3 sat(a) theoretical classes 0 sat(a) practical classes 2 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 classes and exercises, to work and surrender homeworks and working both colloquiums.
Consultations	3 hours for individual work and consultations
Literature	1. Radoš Bulatović, Mašinski elementi I, 2. Vojislav Miltenović, Mašinski elementi, 3. Milosav Ognjanović, Mašinski elementi, 4. Radoš Bulatović, Janko Jovanović, Mašinski elementi – riješeni zadaci, 5. Zoran Savić i grupa autora, Praktikum za vežbe.
Examination methods	Attendance at lectures 4%, homeworks 4% each (total 16%), colloquiums 15% each (total 30%) and are prerequisite for final exam. Final exam 50%. Grading Scale: 100% - 90% A; 90% - 80% B; 80% - 70% C; 70% - 60% D; 60% - 50% E; 50% - 0% F
Special remarks	

Comment			For addtional information on subject contact proffesor			
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