

Course Name: Railways permanent way				
Course Code	Course Status	Semester	ECTS Credits	Number of classes
	Compulsory	II	6	2P+1V+1L
Study programmes: Master academic studies - study programme Civil Engineering; 4 semesters and 120 ECTS credits.				
Conditioned by other courses: /				
Aims of the course: Getting basic knowledge in Railways permanent way				
Learning outcomes: After passing this exam, student will be able to: 1. Knowledge about materials mechanical properties testing methods, 2. Knowledge about the concepts of stress, deformation and internal forces, 3. Knowledge about the concepts of structure stability and dynamic loading.				
Teacher and assistant: Assoc.Prof. Zlatko Zafirovski, Dr-Ing. - teacher Katarina Mirkovic, PhD - assistant				
Methods of teaching and learning: Lectures, exercises, laboratory exercise, consultations, semester project.				
Course content:				
I teaching week	Basic concepts of permanent way elements: rails, fastenings, sleepers, ballast			
II teaching week	Rails: shape, strength, testing and inspection			
III teaching week	Rails: deterioration, lubrication			
IV teaching week	Fastenings: tasks and fastenings testing, rigid and elastic as tenings			
V teaching week	Sleepers: timber sleepers, reinforced-concrete sleepers, manufacturing and testing			
VI teaching week	Ballast: tasks, shapes and dimensions of ballast prism, bearing increase of ballast prism			
VII teaching week	PRE-EXAM I			
VIII teaching week	Track arrangement: track gauge, super elevation, transition curve and gradient			
IX teaching week	Permanent way design: static and dynamic track design			
X teaching week	Ballast less permanent way structures: structure requirements, application			
XI teaching week	Continuous welded rails (CWR): temperatures and stresses			
XII teaching week	Rail welding procedures: termite welding, electrical resistance welding, weld testing High speed railways: characteristics, horizontal and vertical alignment elements			
XIII teaching week	Turnouts: elements, types, function, crossings (frogs) and guiderails			
XIV teaching week	PRE-EXAM II			
XV teaching week	Summary and preparation for the final exam.			
Student's obligations: Attending of lectures and exercises, elaboration of semester project, passing of pre-exams.				
STUDENTS LOAD				
<u>Per week</u>	<u>In semester</u>			
6 credits x 40/30 = <u>8 hours</u>	Teaching and final exam: (8 hours) x 16 = <u>128 hours</u>			
Structure:	Necessary preparations before semester (administration, enrolment etc)			
3 hours lectures	2 x (8 hours) = <u>16 hours</u>			
3 hours exercises	Total load for the course: <u>6x30 = 180 hours</u>			
2 hours individual work, including consultations	Additional work for exam preparation in the additional exam session, including passing of correctional exam <u>between 0 and 36 hours</u> (remaining time from the previous issues to the final load for the course of 180 hours)			
	Load structure: 128 hours (teaching) + 16 hours (preparation) + 36 hours (additional work)			
Literature: <u>Basic literature:</u>				
1. Zdenka Popović, <i>Osnove projektovanja železničkih pruga</i>				
2. C.Esveld, <i>Modern Railway Track, Second Edition</i> , MRT Productions, Zaltbommel, 2001,				
3. Pravilnik o održavanju gornjeg stroja željezničkih pruga (Regulations on the maintenance of permanent way, Official Gazette).				
Examining system and grading:				
Examining is continuous during the semester and in the final exam.				
Maximum number of points in semester: 100. Maximum number of points at final exam: 50.				
The structure of examination and points is as follows:				
- semester project:	15 do 30	(min positively marked part of semester project = 4.5 points);		
- pre-exams:	2 x (10 do 20) = 20 do 40	(min positively marked pre-exam = 15 points);		
- final exam:	do 50	(min positively marked final exam = 25 points).		
Pre-exams and final exam are in written form.				
Positive grade is obtained for min 51 points.				
Special notes for the course:				
Data prepared by teacher: Assoc.Prof Zlatko Zafirovski, Dr-Ing.				
Note: Additional information on course may be obtained from course teacher, assistant, head of the study programme and vice-dean for teaching.				