



GRADUATE STUDY: **TRAFFIC AND TRANSPORT, RAILWAY TRANSPORT**

Syllabus

Academic year 2023/2024

Course:		Railway Vehicles Maintenance			
Head of course: Assoc. Prof. Mladen Nikšić , Ph.D.					
Co-lecturers: Denis Šipuš , Ph.D.					
Semester: III	Course code: 36078	Lectures: 30	Auditory exercises: 30	Laboratory exercises: 0	ECTS credits: 5
Group for lectures: 10 students			Group for auditory and laboratory exercises: 10 students		

Objective of the course:

- Acquisition of knowledge and skills necessary for: planning, organizing and control of rolling stock maintenance process,
- Selection of an optimal maintenance model by types of vehicles and maintenance workshops,
- Determining the shape of the rolling stock structure considering potential integral logistic support of the system.

Learning outcomes:

After the completion of the course the students will be able to:

1. Define certain types of rolling stock maintenance processes
2. Explain the advantages and disadvantages of different rolling stock maintenance technologies by appliance of Multi-criteria decision analysis
3. Select the optimal maintenance model for different type of rolling stock
4. Calculate maintaining capacities
5. Recommend an appropriate model of optimal rolling stock maintenance process
6. Develop a technological process for the rolling stock maintenance based on model results and optimal solution selections.



LECTURES and EXERCISES

Week	Syllabus	Form of classes	Performed by	Lessons	Remark
1.	<ul style="list-style-type: none">Introduction to the rolling stock maintenanceProbability Theory in Technical Exploitation of Vehicles	L	Mladen Nikšić	2	
	<ul style="list-style-type: none">Normal, Weibull, Gauss, exponential and logarithmic distribution	AE	Mladen Nikšić	2	
2.	<ul style="list-style-type: none">ReliabilityFailure rate "the bathtub curve"	L	Mladen Nikšić	2	
	<ul style="list-style-type: none">Mean time between failures (MTBF) calculation	AE	Mladen Nikšić	2	
3.	<ul style="list-style-type: none">AvailabilityTimeline of system activity	L	Mladen Nikšić	2	
	<ul style="list-style-type: none">Factors of system availability.	AE	Mladen Nikšić	2	
4.	<ul style="list-style-type: none">EffectivenessFunctional advantage	L	Mladen Nikšić	2	
	<ul style="list-style-type: none">Cost effectiveness analysis.	AE	Mladen Nikšić	2	
5.	<ul style="list-style-type: none">Maintenance types for railway vehicle.	L	Mladen Nikšić	2	



	<ul style="list-style-type: none">Scheduling deadlines and ordering of a particular type of maintenance according to the series of railway vehicles	L	Mladen Nikšić	2	
6.	<ul style="list-style-type: none">Preventive maintenance	L	Mladen Nikšić	2	
	<ul style="list-style-type: none">Reliability centered maintenance	L	Mladen Nikšić	2	
7.	<ul style="list-style-type: none">Corrective maintenance	L	Mladen Nikšić	2	
	<ul style="list-style-type: none">Calculation of required capacity for corrective maintenance based on indicators from the previous period	AE	Denis Šipuš	2	
8.	<ul style="list-style-type: none">Tehnology of Rolling stock maintenance	L	Mladen Nikšić	2	
	<ul style="list-style-type: none">Calculation of justification for the application of the aggregate maintenance method in a particular workshop	AE	Mladen Nikšić	2	
9.	<ul style="list-style-type: none">The essential elements of the modern rolling stock maintenance model - Part I	L	Mladen Nikšić	2	
	<ul style="list-style-type: none">Examples of vehicle condition by domestic stations and traction relations	AE	Denis Šipuš	2	
10.	<ul style="list-style-type: none">The essential elements of the modern rolling stock maintenance model - Part II	L	Mladen Nikšić	2	
	<ul style="list-style-type: none">Examples of daily, weekly, monthly, quarterly, annual and mid-term maintenance plans	AE	Mladen Nikšić	2	



11.	<ul style="list-style-type: none"> Maintenance of towing vehicles 	L	Mladen Nikšić	2	
	<ul style="list-style-type: none"> Examples of making Gantt diagram of arrival and departure towing vehicles on maintenance 	AE	Denis Šipuš	2	
12.	<ul style="list-style-type: none"> Maintenance of towed vehicles 	L	Mladen Nikšić	2	
	<ul style="list-style-type: none"> Examples of making Gantt diagram of arrival and departure towed vehicles on maintenance 	AE	Denis Šipuš	2	
13.	<ul style="list-style-type: none"> Places for Rolling stock maintenancing 	AE	Denis Šipuš	2	Technical visit of TŽV Gredeļ Technical visit of TŽV Gredeļ
	<ul style="list-style-type: none"> Places for Rolling stock maintenancing 	AE	Matea Mikulčić	2	
14.	<ul style="list-style-type: none"> Technical documentation for vehicle maintenance. 	L	Mladen Nikšić	2	
	<ul style="list-style-type: none"> Calculation of capacity for vehicle maintenance. 	AE	Denis Šipuš	2	
15.	<ul style="list-style-type: none"> Regulations for the rolling stock maintenance 	AE	Mladen Nikšić, Denis Šipuš	2	
	<ul style="list-style-type: none"> Technological processes of passenger units and trains in technical-passenger stations 	AE	Denis Šipuš	2	

L = Lectures; AE = Auditory Exercises; LE = Laboratory Exercises; S = Seminars





STUDENT OBLIGATIONS AND EXAMS

Conditions for obtaining signatures:

Attendance is mandatory and students are required to attend at least 70% of the classes. In addition, at the end of the course students are required to write and present their seminar paper and to pass written and oral examination.

Written exam:

Written test is administered on paper and computer. Students are required to answer five questions related to course topics and demonstrate their knowledge of rolling stock maintenance processes.

Oral exam:

Students are required to answer questions in such a way so as to demonstrate sufficient knowledge of the subject matter in order to pass the oral exam.

LITERATURE

a) Obligatory literature:

1. Nikšić, M.: Održavanje željezničkih vozila, autorizirana predavanja (<http://e-student.fpz.hr>), Fakultet prometnih znanosti, Zagreb
2. Nikšić, M; Mlinarić, T.J.; Brkić, M.: Održavanje željezničkih vozila, Fakultet prometnih znanosti, Zagreb (in process)

b) Recommended literature:

1. Blanchard, M.S.: Logistic Engineering and Management, Prentice-Hall, Inc 1974, 1981.





METHODOLOGY OF THE IMPLEMENTATION OF THE COURSE PLAN

1. LECTURES

In the course of the lectures the theoretical framework of the curriculum is presented and followed by practical examples. To this end Power Point presentations are used.

2. AUDITORIAL EXERCISES

In the course of exercises students are required to practice diverse calculations solving challenges in order to define all necessary parameters for a railway transport system.





1. DOCUMENTATION

Attendance list is signed by students prior to every lecture.

2. ECTS CREDITS

Activity	ECTS credits
Class attendance	2
Oral exam	1
Written exam	2
In total:	5

METHODS OF MONITORING QUALITY THAT ENSURE ACQUISITION OF EXIT COMPETENCES

The student's attendance record is kept during the semester. At the end of the semester an evaluation of the quality and efficiency of the course and the lecturers will be carried out. Information on the achievement of learning outcomes and student progress will be used by teachers for self-evaluation and improvement of teaching methods.

