GRADUATE STUDY: TRANSPORT

SEMESTER (III)

Syllabus

Academic year 2023/2024

Course: **Simulations of Railway Operations**					
Head of course: Asst. Prof. **Marjana Petrović**, Ph.D.					
Co-lecturers: **Matea Mikulčić**, MSc Traff. Eng.					
Semester: **III**	Course code: **126048**	Lectures: **30**	Auditory exercises:	Seminars: **15**	ECTS credits: **3**
Group for lectures: **10 students**			Group for auditory and laboratory exercises: **10 students**		

Objective of the course:

- explain methodology of conducting simulations in railway transport
- explain the purpose of simulation analysis

Learning outcomes:

After the completion of the course the students will be able to:
1. apply different simulation tools to solve railway transport related problems
2. conduct analysis and be able to explain simulation results
3. evaluate different solutions of the railway related problems
4. use of simulation methods for process optimization

LECTURES and SEMINARS

Week	Syllabus	Form of classes	Performed by	Lessons	Remark
1.	▪ Introduction to the area of railway simulation ▪ historical development of simulation modelling	L	Marjana Petrović	3	
2.	▪ Simulation models in railway transport	L	Marjana Petrović	3	
3.	▪ Problem definition and usage of the appropriate simulation tools	L	Marjana Petrović	3	
4.	▪ Application of computer tools for modelling and simulation of rail operations - VISUM	L	Marjana Petrović	3	
5.	▪ Application of computer tools for modelling and simulation of rail operations - VISUM	L	Marjana Petrović	3	
6.	▪ Application of computer tools for modelling and simulation of rail operations - VISSIM	L	Marjana Petrović	3	
7.	▪ Application of computer tools for modelling and simulation of rail operations - VISSIM	L	Marjana Petrović	3	
8.	▪ Application of computer tools for modelling and simulation of rail operations - GIS	L	Marjana Petrović	3	
9.	▪ Application of computer tools for modelling and simulation of rail operations - GIS	L	Marjana Petrović	3	

10.	▪ Analysing simulation experiments	L	Marjana Petrović	3	
11.	▪ Simulation of railway operations on single track railway line	S	Matea Mikulčić	3	
12.	▪ Simulation of railway operations on double track railway line	S	Matea Mikulčić	3	
13.	▪ Simulation of railway operations in marshalling yards	S	Matea Mikulčić	3	
14.	▪ Computer modelling and simulation ▪ of rail operations (OpenTrack simulation tool)	S	Matea Mikulčić	3	
15.	▪ The use of simulation for track ▪ capacity assessment (UIC 406 method)	S	Matea Mikulčić	3	

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 50% of the classes and make Seminar.

Written and oral exam: At the end of the course students are obligatory to present their seminar work and pass an oral examination. The student has to answer the question in such a way as to demonstrate sufficient knowledge of the subject in order to pass the oral exam.

LITERATURE

a) Obligatory literature:

1. I.A. Hansen, J. Pahl: Railway Timetable & Traffic – Analysis – Modelling - Simulation, EURAIL PRESS 2008.
2. C.A. Chung: Simulation Modeling handbook – A practical Approach, CRC Press, 2004.

b) Recommended literature:

1. Pachl, J.: Railway Operation and Control 2nd edition, VTD Rail Publishing, Mountlake Terrace, USA, 2009.
2. Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software, FHA, 2004.
3. PTV VISUM 14 – manual, Karlsruhe, 2014

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. SEMINARS

Using previously developed computer model students need to simulate different scenarios and problems related to railway transport.

3. DOCUMENTATION

Attendance list is signed by students prior to every lecture.

4. SCORING SYSTEM

Table 1 The scoring system for the monitoring of students and explained credit values in ECTS credits

Activity	ECTS credits
Lectures	**1**
Seminar	**0,5**
Oral exam	**1,5**
In total:	**3**

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.