**“Communications and Localization Systems for Railways”**

**Syllabus SCR.04/3**

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Version 1

# Name of the course

**Communications and Localization Systems for Railways**

# ECTS credits

6 Credits, **(45H Theory; 30H Exercises + Lab), 3rd semester**

This lecture provides students with basic knowledge in the field of analytical use of communications and localization systems in railway transport. The lectures should acquaint students with railway transport technologies, teach to use the selected information systems and interlocking systems in field of railway transport in laboratory conditions and prepare students for their implementation practice in management of other transport companies.

# Objectives

The main objectives of this lecture are following:

* International Electronic Data Interchange
* Technical Specification for Interoperability (TSI)
* Information systems in each Railway Companies (Infrastructure managers and Railway Undertakings)
* Localization systems in Railway transport
* European Railway Transport Management System (ERTMS)
* European Train Control Systems (ETCS)
* NAVIGATION SYSTEMS AND APPLICATION IN RAILWAY TRANSPORT
* Satellite navigation system with application in Railway transport
* System for tracking railway wagons and locomotives

# Learning outcomes

The general expectation regarding the knowledge to be provided/acquired is as follows:

* analytical work in the field of railway information systems and location systems;
* addressing basic and consequently more complex problems in the operational management of rail transport under laboratory conditions;
* solving basic and consequently more complicated problems of using localization systems for railway traffic control in laboratory conditions;
* with infrastructure manager information systems to address specific application problems; resp. management and decision-making in critical rail traffic situations;
* using of GNSS and other ICT techniques as support for decision-making in rail transport.

# Contents

1. INTRODUCTION
	1. Definition of the term ICT and Localization systems in railway transport
	2. History of Railway separation process
	3. History of ICT in railway transport
	4. Introductory terms
		1. Information systems in Railway Transport and ICT
		2. Localization systems in Railway Transport and ICT
2. THE International support for information systems in Railway transport
	1. Network Hermes
		1. History of Hermes network
		2. Actual services in Hermes network
	2. Technical specification of Interoperability in EU
		1. TSI – introduction
		2. TAF TSI – Technical Specification for Interoperability relating to Telematics Applications for Freight Services
		3. TAP TSI – Technical Specification for Interoperability relating to Telematics Applications for Passenger Services
	3. The basic elements for control in Railway transport
		1. The basic elements in passenger transport
		2. The basic elements in freight transport
3. Information systems of Infrastructure manager
	1. Operational Information system
	2. Train dispatcher system
	3. Automatization workstation of station dispatcher
	4. Communication between The Infrastructure manager information systems
4. Information systems of Railway undertakings
	1. Information systems in Passenger railway undertaking
	2. Information systems In Freight railway undertakings
5. Localization systems in railway transport
	1. European Railway Transport Management System (ERTMS)
	2. European Train Control Systems (ETCS)
		1. ETCS L1
		2. ETCS L2
		3. ETCS L3
		4. ETCS LC
6. NAVIGATION SYSTEMS AND APPLICATION IN RAILWAY TRANSPORT
	1. Introduction to satellite navigation
	2. Global satellite navigation systems and application in Railway transport
	3. GPS and application in Railway transport
	4. Satellite navigation system Galileo with application in Railway transport
	5. System for tracking railway wagons and locomotives
7. COMUNICATION SYSTEMS FOR RAILWAYS

7.1 TETRA

7.2 GSM rail

7.3 5G for railways

# EXCERCISES

# Independent analytical work in the field of railway information systems and location systems;

# Addressing basic and consequently more complex problems in the operational management of rail transport under laboratory conditions;

# Solving basic and consequently more complicated problems of using localization systems for railway traffic control in laboratory conditions;

# Work with information systems of infrastructure manager to address specific application problems; resp. management and decision-making in critical rail traffic situations;

# Creative use of GNSS and other ICT techniques as support for decision-making in rail transport.

# Teaching method

Lectures, case studies, tutorials/exercises

− The presentations are available for the whole course. They will be provide to students (or uploaded in the IS MOODLE). The full contents of each slides are systematically explained by the Lecturer. Additional examples which are not included in the presentations are proposed by the Lecturer to allow good understanding of the information provided.

− The presentations contain exercises with solutions for the good understanding of the content of each chapter. These solutions are systematically explained (during the lecture) by the Lecturer.

− The presentations contain also exercises without solutions. They should be solved by students during the lecture (this is part of oral exam). The students are fully assisting by the Lecturer in order to obtain correct/exact solutions to the proposed exercises. This should help to check whether the students have understood the chapters or not.

− Several exercises are propose by the Lecturer to be solve by students as projects. This should help to test the self-learning potential of students.

# Assessment method

Mid-term and final oral and/or written examination, exercises from case studies.

# Textbooks - Publications - Software

**Textbooks**

* Gašparík, J. and col.: Railway Traffic Operation. Žilina: EDIS, 2016. 275 pages.
* Čamaj, J. – Gašparík, J.: Information and communication technologies in Railway Transport. Žilina: EDIS, 2010. 179 pages.
* Sladkowski, A. and col.: Rail transport – Systems Approach. Springer, 2017.
* Winter, P.: Compendium on ERTMS: European Rail Traffic Management System. UIC, 2009
* Stanley, P.: ETCS for Engineers. Eurail press, 2011.
* INTERNATIONAL TEXTBOOKS ON COMUNICATION SYSTEMS FOR RAILWAYS

**Selected relevant Publications**

* <https://www.era.europa.eu/activities/technical-specifications-interoperability_en>
* <http://www.rne.eu/it/taf-tap-tsi/>
* <http://www.raildata.coop/taf>
* <https://www.era.europa.eu/activities/technical-specifications-interoperability_en>
* <https://www.oltisgroup.com/products/freight-transport/tracking/>

Software PLEASE SPECIFY

* Operational information system in manager infrastructure
* Operational Information system in railway undertaking
* Train dispatcher system
* Automatization workstation of station dispatcher
* The Station Interlocking systems in Railway transport
* The Track Interlocking systems in Railway transport