**“Signalling, Command-Control and Safety for Railways“**

**Syllabus SCR.03/3**

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Version 1

# Name of the course

**Signalling, Command-Control and Safety for Railways**

# ECTS credits

6 Credits, **(45H Theory; 30H Exercises)**

This lecture provides students with basic knowledge of the position and role of the signalling and interlocking systems in the process of railway traffic management and of functional and safety requirements for each type of signalling and interlocking systems.

# Objectives

The main objectives of this lecture are following:

* Importance of signalling and interlocking systems and their basic classification,
* Station signalling and interlocking systems - functional and security requirements, function algorithms, principles of technical solutions,
* Track signalling and interlocking systems - functional and safety requirements, function algorithms, principles of technical solutions,
* Train signalling and interlocking systems - functional and security requirements, function algorithms, principles of technical solutions,
* Crossing signalling and interlocking systems - functional and security requirements, function algorithms, principles of technical solutions,
* Centralized railway traffic management systems.

# Learning outcomes

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

* ability to independent operation of the different signalling and interlocking systems,
* independent analytical work in the field of assessment of the use of the signalling and interlocking systems in different technical and operational conditions of railway traffic,
* solving more complicated problems of operational safety of railway traffic in practice;
* acquiring of the basic skills of the rail traffic management.

# Contents

1. Introduction

1.1 The role of the signalling and interlocking systems in the transport process

1.2 Sorting, purpose and characteristics of different types of signalling and interlocking systems.

1. Station safety equipment (SSE)

2.1 Side protection

2.2 Protection track

2.3 Switch functions

2.4 Signal function

2.5 Basic conditions for preparing and cancelling of the train path and the time duration of basic conditions

2.6 Basic principles of the creation of logical dependencies of the SSE

2.7 Division of SSE according to elements used for creation of logical dependencies - basic characteristic, layout of elements in railway track, principle of operation

1. Track safety equipment (TSE)

3.1 Methods of train driving management in movements in interstation section

3.2 Functional and technical requirements, sorting

3.3 Systems for the traffic management in distant block

1. Train safety equipment (TSE)

4.1 Purpose, basic functional and technical requirements

4.2 Sorting

4.3 Controlling of the vehicle speed

4.4 Controlling of the driver operation

4.5 Discontinuous train control

4.6 Continuous train control

4.7 ERTMS/ETCS - building reasons, philosophy solution

4.8 ERTMS/ETCS levels

1. Crossing safety equipment (CSE)

5.1 Basic functional and technical requirements

5.2 Sorting

5.3 Principle of operation

5.4 Light signalling crossing equipment

# Teaching method

Lectures, tutorials/exercises

* The slides are available for the whole course. They are provided to students (or uploaded in the MOODLE system). The full contents of each slide is systematically explained by the Lecturer. Additional examples which are not included in the slides are proposed by the Lecturer to allow good understanding of the information provided.
* The slides 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 slides contain also exercises without solutions. They should be solved by students during the lecture. The students are fully assisted 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 proposed by the Lecturer to be solved 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.

# Textbooks - Publications - Software

* Adams, B., B.: The Block System of Signaling on American Railroads. Franklin Classics, 2018, ISBN 0342203649
* British Railway Signalling Practice: Interlocking Principles and Systems. Institution of Railway Signal Engineers; New Ed edition, 2005, ISBN 090239021X
* Flammini, F.: Railway Safety, Reliability, and Security: Technologies and Systems Engineering. IGI Global, 2012, ISBN 1466616431
* International Compendium: Railway Signalling & Interlocking. Eurailpress Hamburg, ISBN 978-3-7771-0394-5, 2009.
* Nock, O., S.: Railway Signalling. A & C Black Publishers Ltd, 1981, ISBN 0713620676
* Pachl, J.: Railway Operation and Control. VTD Rail Publishing, ISBN 0-9719915-1-0, 2010.
* Railway Operating and Safety Rules. [U.S. Department of Defense](https://www.amazon.com/s/ref%3Ddp_byline_sr_ebooks_1?ie=UTF8&text=U.S.+Department+of+Defense&search-alias=digital-text&field-author=U.S.+Department+of+Defense&sort=relevancerank), Kindle Edition, 2015
* Sciutto, G.: Safety and Security in Railway Engineering. WIT Press, 2010, ISBN 1845644964
* Setola, R. et al.: Railway Infrastructure Security. eBook, Kindle Edition, Springer; 2015, ISBN 3319044257
* Wang, J.: Safety Theory and Control Technology of High-Speed Train Operation. eBook, Kindle Edition, Academic Press, 2017, ISBN 012813304X

ADD SOFTWARE IF POSSIBLE