

Deliverable 3.7.2/T2.7.2

TEACHING AND STUDY MATERIALS FOR EACH MODULE

Leading partner:

TTK / Tallinna Tehnikakõrgkool / TTK University of Applied Sciences



Project partners:

KRAO / Kouvola Rautatie ja Aikuiskoulutus OY



TSI/TTI / Transporta un Sakaru Instituts / Transport and Telecommunication Institute



HAMK / Hämeen ammattikorkeakoulu / Häme University of Applied Sciences



RTU / Rigas Tehniska Universitate / Riga Technical University



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1. Introduction

Teaching and study materials were worked out for selected subjects of 5 study modules. Each study module had a leading partner. The leading partner selected subject (subjects) for which teaching and study materials were worked out. It was necessary that these study materials cover at least 6 credit points per module. All study and teaching materials had the same structure and followed the implemented guidelines, which were prepared by HAMK and TTK.

The following study and teaching materials were worked out:

Module 1 (Responsible partner TTI): Transport Policy Formulation Implementation;

Module 2 (Responsible partner KRAO): General Professional Knowledge and Requirements Regarding the Licence/Traffic Safety;

Module 3 (Responsible partner HAMK): Service Oriented and Intelligent Transport System in the Context of Opening Markets;

Module 4 (Responsible partner RTU): Control and Command Systems of Rail Traffic;

Module 5 (Responsible partner TTK): Logistic Management and Operating of Rail Transport

Access to the above listed study materials may be applied from TTK or from responsible partners of study modules.

2. Guidelines for Working out Teaching and Study Materials

The aim of the module creation is to outline targeted and achieved knowledge and competences, which are common for the curricula of all of the selected five study modules of EDU-RAIL.

Outlining the modules by subject lists will start from defining the below mentioned common basic objectives for all study modules:

- more harmonized and less fragmented railway education curricula as a basis for all modules
- development of the single European Railway Area, (interoperability, regional aspects)
- operating in open market of rail services, ability in team work of multinational environment
- ability to work in digitalized operating environment with cyber risks
- new thinking models for rail business
- evaluating environmental protection aspects, ethic problems and safety and security aspects

In the study process of all modules, it was recommended to stress that engineers of the future will be placed in tasks marked by different engineering skills, namely project management and implementation, process management, design and resource planning.

Outlining of the five EDU-RAIL modules

Module 1 Single European Railway Area, *responsible TTI*

Introduction to the outline of module by subjects (*common for all subjects of module*):

- general objective of the module;
- general outcomes (knowledge and competences, which are common for five subjects of module 1);
- short overall description of content of the module

Short description of knowledge and targeted competences with basic references per all subjects (Themes) of module 1:

- Subject 1 **European Transport Policy**

- Subject 2 **Legislation of Single European Railway Area**
- Subject 3 **Single European Railway Area Content**
- Subject 4 **European Railway Governance**
- Subject 5 **Rail Research and Innovation in Europe**

Outline of all the five subjects of the Module 1 has to follow the structure:

- general objective of the subject;
- learning outcomes (achieved knowledge and skills);
- short description of content of the subject;
- basic references to study materials of the subject

Module 2 General Professional Knowledge and Requirements Regarding the License, responsible KRAO

Introduction to the outline of module by subjects (*common for all subjects of module*):

- general objective of the module;
- general outcomes (knowledge and competences, which are common for five subjects of module 2);
- short overall description of the content of the module

Short description of knowledge and targeted competences with basic references per all subjects (Themes) of module 2:

- Subject 1 **Professional Knowledge of Safety Principles**
- Subject 2 **Professional Knowledge of Trains and Rolling Stock**
- Subject 3 **Professional Knowledge of Railway Technologies**
- Subject 4 **Dangerous Goods**
- Subject 5 **Professional Knowledge of Infrastructure and Risks**

Outline of all five subjects of the Module 2 has to follow the structure:

- general objective of the subject;
- learning outcomes (achieved knowledge and skills);
- short description of the content of the subject;
- basic references for study materials of the subject

Module 3 Service Oriented and Intelligent Transport System in the Context of Opening Markets, *responsible HAMK*

Introduction to the outline of module by subjects (*common for all subjects of module*):

- general objective of the module;
- general outcomes (knowledge and competences, which are common for five subjects of module 3);
- short overall description of the content of the module

Short description of knowledge and targeted competences with basic references per all subjects (Themes) of module 3:

- Subject 1 **Markets - The Opening Railway Markets**
- Subject 2 **Infrastructure - The Needs of the Opening Railway Markets**
- Subject 3 **Services Customised Services, Intelligent Solutions**
- Subject 4 **Case study**

Outline of all four subjects of the Module 3 has to follow the structure:

- general objective of the subject;
- learning outcomes (achieved knowledge and skills);
- short description of content of the subject;
- basic references for the study materials of the subject

Module 4 Control and Command Systems of Rail Traffic, *responsible RTU*

Introduction to the outline of module by subjects (*common for all subjects of module*):

- general objective of the module;
- general outcomes (knowledge and competences, which are common for five subjects of module 4);
- short overall description of the content of the module

Short description of knowledge and targeted competences with basic references per all subjects (themes) of module 4:

- Subject 1 **Train Traffic Management Systems**
- Subject 2 **Policy and Regulations in the Rail Transport**
- Subject 3 **European Rail Traffic Management System ERTMS**

- Subject 4 **Technical Solutions for Interoperability with National and ERTMS Systems**
- Subject 5 **CTC and Real Time Control of Train Movement on Network**

Outline of all five subjects of the Module 4 has to follow the structure:

- general objective of the subject;
- learning outcomes (achieved knowledge and skills);
- short description of content of the subject;
- basic references for study materials of the subject

Module 5 Logistic Management and Operating of Rail Transport, *responsible TTK*

Introduction to the outline of module by subjects (*common for all subjects of module*):

- general objective of the module;
- general outcomes (knowledge and competences, which are common for five subjects of module 5);
- short overall description of the content of the module

Short description of knowledge and targeted competences with basic references per all subjects (Themes) of module 5:

- Subject 1 **Role of the Rail Transport in the Supply Chain**
- Subject 2 **Policy and Regulations in the Rail Transport**
- Subject 3 **Railway Freight Operations and Management**
- Subject 4 **Railway Asset Management and Pricing**
- Subject 5 **Rail Environment and Crew Management**

Outline of all five subjects of the Module 5 has to follow the structure:

- general objective of the subject;
- learning outcomes (achieved knowledge and skills);
- short description of content of the subject;
- basic references for study materials of the subject

Guidelines are prepared by teams of HAMK and TTK

2. Summary Tables of Study Materials for Each Module

3.1 Module 1 (Summary)

MODULE 1 Single European Railway Area (TTI)	
Total volume of the module	15 credit points
General objective of the module	<ul style="list-style-type: none"> • acquiring the skills of applying the main documents of the sphere of the EU transport policy according to the tasks of development of the particular transport organizations • introducing students to the key principles of transport policymaking in an international context • providing students with an understanding of the fundamentals of rail transport planning in the context of wider policy making • equipping students with a conceptual and practical understanding of rail transport appraisal
E-learning subjects,	e-learning materials

Introduction. Content of EDU-RAIL project	
EDU-RAIL project. Brief description	Text
Structure of training programme	Text
Website of project	Hyperlink
General objective and outcomes of the module “Single European Railway Area”	Text

1. European transport policy	
Transport Policy Formulation and Implementation	Text. Presentation. Transport policy. Basic principles. Presentation. European policy on intermodal transport Textbook. Transport Policy Formulation and Implementation
White paper 2011. Roadmap to a Single European Transport Area - towards a competitive and resource efficient transport system	Text White Paper 2011. Official documents of European Commission. White Paper 2011. Presentation.
TEN-T and transport policy	Text TEN-T core network corridors. Official documents of European Commission. TEN-T European Core Network Corridors. Map TEN-T European Core Network Corridors (Video)

2. Legislation of Single European Railway Area	
Railway packages	Text Towards Single European Railway Area. Presentation Digital Single European Railway Area. Presentation
First railway package	Text First railway package. Official documents of European Commission.
Second railway package	Text Second railway package. Official documents of European

	<p>Commission.</p> <p>Second railway package. Hyperlink.</p>
Third railway package	<p>Text</p> <p>Third railway package. Official documents of European Commission.</p> <p>Third railway package. Hyperlink.</p>
Fourth railway package	<p>Text</p> <p>Fourth railway package. Official documents of European Commission.</p> <p>Fourth railway package. Hyperlink.</p> <p>Directive 2012-34-EU -- Establishing a Single European Railway Area</p> <p>Single European Railway Area (Video)</p>

3. Single European Railway Area content	
E-learning material (title) 1	<p>Text</p> <p>The Future of Rail in Europe (video)</p> <p>European Railway System. Part-1. Textbook</p> <p>European Railway System. Part-2. Textbook</p> <p>European Railway System. Part-3. Textbook</p> <p>Digital Single European Railway Area-1. Textbook</p> <p>Digital Single European Railway Area-2. Textbook</p>

4. European Railway Governance	
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European Railway Agency	Text European Railway Agency. Hyperlink
The European Rail Network for Competitive Freight	Text Regulation EU 913/2010 - European Rail Network for Competitive Freight. Official documents of European Commission.
E-learning material	Type of e-learning material (presentation, text book, official documents of European Commission, hyperlinks to websites, multimedia)

5. Rail Research and Innovation in Europe	
Shift2Rail	Text Shift2Rail. Hyperlink Shift2Rail. Video
Rail Research and Shift2Rail	Text Council Regulation No 642/2014 of 16 June 2014 establishing the Shift2Rail Joint Undertaking Файл Shift2Rail: driving innovation on railways. Textbook European Transport Research and Innovation. Textbook Research for a Smart and Competitive Railway System. Textbook

6. Assessment Centre	
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7. Additional information	
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3.2 Module 2 Materials (Summary)

MODULE 2 General Professional Knowledge and Requirements Regarding the Licence (KRAO)	
Total volume of the module	15 credit points
General objective of the module	<ul style="list-style-type: none"> • acquiring knowledge and procedures regarding of railway technologies, including safety principles and the philosophy behind operational regulations • acquiring knowledge and procedures regarding the risks related to railway operation and the various means to be used to combat them • acquiring knowledge and procedures regarding the principles guiding one or more railway operating modes • acquiring knowledge and procedures regarding trains, their composition and technical requirements on traction units, wagons, coaches and other rolling stock
General outcomes of the module	After completing the module, the students have the systematic knowledge of the train driver competence on all aspects that are relevant to the train driver's profession. The acquisition of professional knowledge and skills are reducing the fragmentation of railway engineering education and support the better understanding the EU Railway System and Legislation.
Structure of the module	<p>The curriculum consists of the following subjects:</p> <ol style="list-style-type: none"> 1. Professional Knowledge of Safety Principles 2. Professional Knowledge of Trains and Rolling Stock 3. Professional Knowledge of Railway Technologies 4. Dangerous Goods 5. Professional Knowledge of Infrastructure and Risks

Module subject(s), their objective and learning outcomes	
1. Professional Knowledge of Safety Principles	3 credit points
General objective	To provide an overview of the train driver, the work environment, the driver's role and responsibility in the process of rail operation, the professional and personal demands of the driver's duties including safety principles and the philosophy behind operational regulations. Knowledge and procedures regarding the principles guiding one or more railway operating modes.
Learning outcomes	To understand the specific requirements for working in the profession of driver. To understand the professional and personal demands, apply staff safety rules, know and apply a working method in a precise manner, identify the reference and applications documents, manual of procedures and manual of lines as defined in the 'Operations' TSI, driver's manual, breakdown manual, learn behaviours which are compatible with safety-critical responsibilities, distinguish the hazards involved in railway operations in general, know the principles governing traffic safety.
Topics of the subject	<i>Study materials are in the form of the deliverables Activities 3.1 Licence KRAO version 2 prepared by Hannu Jalonen</i>
2. Professional Knowledge of Trains and Rolling Stock	3 credit points

General objective	To provide an overview of trains, their composition and the technical requirements for traction units, wagons, coaches and other rolling stock.
Learning outcomes	Identify rolling stock. Drivers must be familiar with all the controls and indicators placed at their disposal, in particular those concerning traction, braking, traffic safety-related elements
Topics of the subject	<i>Study materials are in the form of the deliverables Activities 3.1 certificate rolling stock KRAO version 2.docx. prepared by Hannu Jalonen</i>
3. Professional Knowledge of Railway Technologies	3 credit points
Objective	To provide an overview of the railway technologies, including safety principles behind operational regulations, basic principles of operational communication, knowledge and procedures regarding of railway technologies.
Learning outcomes	<ul style="list-style-type: none"> • to know the principles, regulations and provisions regarding safety in rail operation • to identify the responsibilities and functions of persons involved
Topics of the subject	<i>Study materials are in the form of the deliverables Activities 3.1 Licence KRAO version 2 prepared by Hannu Jalonen</i>
4. Dangerous Goods	3 credit points
Objective	Acquiring the knowledge and procedures regarding dangerous goods
Learning outcomes	The student understands the specific requirements for working in the profession of driver. To understand the professional and personal demands, apply staff safety rules, know and apply a

	working method in a precise manner related to dangerous goods.
Topics of the subject	<i>Study materials are in the form of the deliverables Specific course material in Finland prepared by Hannu Jalonen</i>
5. Professional Knowledge of Infrastructure and Risks	3 credit points
Objective	To acquire knowledge of testing the brakes, type of operation and maximum train speed according to the line characteristics; to obtain knowledge of the line, safety regulations, driving the train.
Learning outcomes	The student understands forces at the wheel, to identify factors influencing accelerating and braking performance (weather conditions, braking equipment, reduced adhesion, sanding, etc.), to understand principles of electricity (circuits, measuring voltage, etc.).
Topics of the subject	<i>Study materials are in the form of the deliverables Activities 3.1 certificate infrastructure KRAO prepared by Hannu Jalonen</i>

3.3. Module 3 Materials (Summary)

MODULE 3 Service Oriented and Intelligent Transport System in the Context of Opening Markets (HAMK)	
Total volume of the module	15 credit points
General objective of the module	Opening the national railway market that has until now been based on a national monopoly to competition is a challenging task for each EU country which calls for demands of a long period for preparations. In Module 3, HAMK examines this preparation for competition through elements involved in the

	<p>opening up of the Finnish railways to competition. In Finland, the process of opening the railways for competition has advanced well and true competition in the market can begin by 2020. In the Module HAMK, the main focus is on the passenger traffic; the review of cargo traffic is covered on general level.</p>
<p>General outcomes of the module</p>	<p>During the module, the students perceive the needs of the infrastructure in an operational environment where the market is opened up to competition. New tools such as digitalization and service design can be used at the same time as there is a need to develop and customize operator based service products.</p> <p>The students also get the overview of new general working life needs such as the tendering process and economic thinking, perceive what the change in the market is, learn about teamwork and communication skills. During the case study, students can practice the skills they have learned during the course and also the skills they have acquired earlier.</p>
<p>Structure of the module</p>	<p>The curriculum consists of the following subjects:</p> <ol style="list-style-type: none"> 1. Market - The Opening Railway Market, volume of the subject 5 credit points <i>Study materials are in the form of the deliverables 3.2. 1/3 to 3.3. 1/3 prepared by Teppo Sotavalta</i> 2. Infrastructure - The Needs of the Opening Railway Market, volume of the subject 3 credit points 3. Customised services, Intelligent Solutions, volume of the subject 4 credit points 4. Case study, volume of the subject 3 credit points
<p>Module subjects, their objective and learning outcomes</p>	

1. Market - The Opening Railway Market	5 credit points
General objective	<p>The passenger traffic market is changing through a tendering process in the big Helsinki area by year 2021 The long distance train market will be opened for the competition in year 2024. What kind of changes can we expect? The freight market opened to competition in 2007. What kind of changes have we seen because of that? What is the situation today? How are the changes reflected in the traditional railway professions in the labour market?</p>
Learning outcomes	<p>The student:</p> <ul style="list-style-type: none"> • knows the principles of the changes in the railway market; • understands the Theory of Competition; • knows the experiences of other countries in the introduction of competition to railways; • understand the progress and the timelines of how the passenger rail transport opens to competition in Finland
Topics of the subject	<p>The General Framework</p> <ul style="list-style-type: none"> - completed enquiries and reports - on competition and tendering/Honkatukia - experiences of other countries in the introduction of competition to railways - some conditions for the introduction of competition (MTC working group 2009-2010) - conclusions and recommendations (MTC 21/2012) - recommendations (Honkatukia) <p>Passenger Rail Transport Opens to Competition</p> <ul style="list-style-type: none"> - tendering postponed by new contracts

	<ul style="list-style-type: none"> - passenger rail transport opens to competition, press release 09.08.2017 - factsheet 73/2017 (published 9.8.2017) - factsheet 74/2017 (published 9.8.2017) - factsheet 77/2017 (published 17.8.2017) - passenger rail transport opens to competition – information event 4th of October - introducing passenger rail transport competition - the MTC notification regarding the upcoming tendering of commuter transport (tenders electronic daily (TED) 15th of September 2017) <p>Background material ordered from consultants</p> <ul style="list-style-type: none"> - Carnegie report no. 1 - Carnegie report no. 2 - regional reviews of passenger rail transport (preparatory studies for the preparation of the introduction of competition to passenger rail transport, Ramboll/Strafica) - documentation and billing systems
<p>2. Infrastructure - The Needs of the Opening Railway Market</p>	<p>3 credit points</p>
<p>General objective</p>	<p>During the last ten years, the authorities have made the necessary changes to the railway infrastructure before opening the market for tendering in the big Helsinki area and before competition in the long distance train market can start. What kind of changes has this caused to the freight traffic? On 9th of August 2017, press conference announced the structural reforms that will be made before the opening of passenger rail to competition.</p>
<p>Learning outcomes</p>	<p>The student:</p>

	<ul style="list-style-type: none"> • knows the changes that have been made to the railway infrastructure before opening the market; • knows where the need arises; • understand the process of the changes; • understand the targets of 9th of August 2017 press conference on structural reforms
Topics of the subject	<p>The Need for Structural Changes</p> <ul style="list-style-type: none"> - EU legislation (railway packages 1, 2, 3 and 4) <p>The Timeline of the Structural Changes</p> <ul style="list-style-type: none"> - the changes: timeline and timing 9th of August 2017 Structural Reforms - the impact of recent reforms on competition
3. Customised Services, Intelligent Solutions	4 credit points
Objective	There will be more operators on the market. How to customize your service products? New tools such as digitalization and service design are available; at the same time, there is a need to develop and customize operator-based service products.
Learning outcomes	<p>The student:</p> <ul style="list-style-type: none"> • understands where to compete in the railway market; • knows how to customize service products; • understand the elements of the service product; • knows the possibilities of digitalization in public transportation sector
Topics of the subject	<p>Railway Market – where to compete</p> <ul style="list-style-type: none"> - what is competition on the railway market <p>Customizing a Service Product</p> <ul style="list-style-type: none"> - service products

	<ul style="list-style-type: none"> - service design - how to customize - open market and competition <p>What is our Customer Promise</p> <ul style="list-style-type: none"> - keep it simple - the meaning of quality
8. Case Study	3 credit points
Objective	<p>According to the students' interest in the assignment, the case study targets are in the commuter, long distance or freight traffic. During the case study, students can practice the skills they have learned during the course and also the skills they have acquired earlier.</p>
Learning outcomes	<p>The student:</p> <ul style="list-style-type: none"> • will have practiced the skills they have learned during the course and also the skills they have acquired earlier
Topics of the subject	<p>Case Study</p> <ul style="list-style-type: none"> - the topic depends on student's interest (commuter, long distance, freight)

3.4

Module 4 Materials (Summary)

Module 4: Control and Command Systems of Rail Traffic, responsible RTU	
Total volume of the module	15 credit points
General objective of the module	The aim of the course is to provide students with fundamental knowledge of control and command systems of rail traffic, taking into consideration the different types of traffic management systems and analysing their structure and basic safety solutions.
General outcomes of the module	<p>Knowledge and understanding</p> <p>For a passing grade, the student must:</p> <ul style="list-style-type: none"> • have an understanding of the construction of the train traffic management systems; • know the principles of operation systems; • be able to classify and analyse the different kinds of train traffic management systems <p>Competences and skills</p> <p>For a passing grade, the student must:</p> <ul style="list-style-type: none"> • have the skills to design train traffic management systems; • have knowledge of systems maintenance and diagnostics; • have an understanding of the technical and design documentation
Structure of the module	The curriculum consists of the following subjects:

	<ol style="list-style-type: none"> 1. Train Traffic Management Systems 2. Policy and Regulations in the Rail Transport 3. European Rail Traffic Management System ERTMS 4. Technical Solutions for Interoperability with National and ERTMS Systems 5. CTC and Real Time Control of Train Movement on Network
Module subject(s), their objective and learning outcomes	
1. Train Traffic Management Systems	4 credit points
General objective	The aim of the course is to provide students with fundamental knowledge of control and command systems of rail traffic, taking into consideration the different types of traffic management systems, their structure and basic safety solutions
Learning outcomes	<ul style="list-style-type: none"> • students have an understanding of the construction of the train traffic management systems; • students know the principles of operation systems; • students are able to classify and analyse the different kinds of train traffic management systems • students have the skills to design train traffic management systems; • students have knowledge of systems maintenance and diagnostics; • students understand of the technical and design documentation
Topics of the subject	1. Control Systems and Their Main Characteristics

	<p>2. Microprocessor Centralisation Systems</p> <p>3. Exam Test</p>
<p>2. Policy and Regulations in the Rail Transport</p>	<p>4 credit points</p>
<p>General objective</p>	<p>To acquire knowledge on the regulatory framework of both Russian and European Union railways; knowledge on international organizations in the field of railway transport.</p>
<p>Learning outcomes</p>	<p>For a passing grade, the student must:</p> <ul style="list-style-type: none"> • know the basic international treaties in the field of international passenger transportation (СМПС, КОТИФ/ЦИВ); • know the basic parameters for the following subsystems: infrastructure (track and track facilities), rolling stock (locomotives and passenger wagons, motor-wagon rolling stock) • know the basis of the interoperability policy and structure of technical specifications, its application features on the basis of contact group ОСЖД/ЕЖДА work in the interaction of railway system track 1520mm/1435mm; • be able to navigate in the international organizations normative-technical documentation in the field of railway (ОСЖД, ОТИФ, МСЖД) and know basic tendencies of development
<p>Topics of the subject</p>	<ol style="list-style-type: none"> 1. The European Experience of Forming the Regulatory and Legal Framework 2. Activities of international railway organizations

	3. Exam Test	
3. European Rail Traffic Management System ERTMS	2 credit points	
Objective	The aim of the course is to provide students with knowledge of European Rail Traffic Management System, and show principles of the system and its implementation at various levels.	
Learning outcomes	<p>For a passing grade, the student must:</p> <ul style="list-style-type: none"> • have an understanding of the construction of the European Rail Traffic Management System; • know the principles of operation system; • be able to classify and analyse different levels and equipment; • have the skills to design European Rail Traffic Management System; • have knowledge on the system's maintenance and diagnostics; • have an understanding of the technical and design documentation 	
Topics of the subject	<ol style="list-style-type: none"> 1. Innovative Aspects of ERTMS 2. Description and Levels of ERTMS 3. Exam Test 	
4. Technical Solutions for Interoperability with National and ERTMS Systems	2 credit points	
Objective	Course objective is to teach students to design a variety of technical solutions for interfacing different kinds of systems.	

<p>Learning outcomes</p>	<p>For a passing grade, the student must:</p> <ul style="list-style-type: none"> • have an understanding of the problem to interfacing different systems; • have an understanding of different rules for different systems • know the principles of technical solutions for system interfacing • have the skills to design technical solutions for system interfacing • have knowledge on systems' maintenance and diagnostics • have an understanding of the technical and design documentation
<p>Topics of the subject</p>	<p>1. Technical Specifications for Interoperability 2. Exam Test</p>
<p>5. CTC and Real Time Control of Train Movement on Network</p>	<p>3 credit points</p>
<p>Objective</p>	<p>The aim of the course is to provide students with fundamental knowledge of CTC and real time control of train movement on network. Also, the course objective is to provide definitions and concepts for the organization of remote and automated train movement control.</p>
<p>Learning outcomes</p>	<p>For a passing grade, the student must:</p> <ul style="list-style-type: none"> • have an understanding of the task and objectives of the CTC systems; • know the principles of real time control of train movement; • be able to classify and analyse the different kind of CTC and real time control systems; • have the skills to design CTC and real time control system;

	<ul style="list-style-type: none"> • have knowledge on systems' maintenance and diagnostics; • have an understanding of the technical and design documentation
Topics of the subject	<ol style="list-style-type: none"> 1. Tasks of CTC and Real Time Control System 2. CTC and Teal Time Control Systems 3. Exam Test

3.5 Module 5 Materials (Summary)

MODULE 5 Logistic Management and Operating of Rail Transport (TTK)	
Total volume of the module	15 credit points
General objective of the module	This module is centred on the transportation systems and on the role of rail freight systems and their components. The module provides knowledge and skills in fields of logistics management and railway technology and management.
General outcomes of the module	After completing the module, the students have systematic knowledge of the logistics and transport systems and operating of rail transport.
Structure of the module	<p>The curriculum consists of the following subjects:</p> <p>Role of the Rail Transport in the Supply Chain, volume of the subject 3 credit points</p> <p>Implementation of Policy and Regulations in the Rail Transport, volume of the subject 3 credit points</p> <p>Railway Freight Operations and Management, volume of the subject 3 credit points</p>

	<p>Railway Asset Management and Pricing, volume of the subject 3 credit points <i>Study material is in the form of the Deliverables 3.2.1-5.1, prepared by Ott Koppel</i></p> <p>Environment and Cross-Border Resource Management in Rail Transport, volume of the subject 3 credit points <i>Study materials are in the form of the deliverables 3.2.1 - 5.2 to 3.2.1- 5.4 prepared by Viive Kirsipuu, Martin Kuusk, Rita Ojala</i></p>
<p>Module subjects, their objectives and learning outcomes</p>	
<p>1. Role of the Rail Transport in the Supply Chain</p>	<p>3 credit points</p>
<p>General objective</p>	<p>To integrate regularities of general logistics and rail-specific process(es)</p>
<p>Learning outcomes</p>	<p>The student:</p> <ul style="list-style-type: none"> • knows the principles of functioning of the rail system; • is able to evaluate the advantages and disadvantages inherent in the rail mode of transport choice; • understands the difference between an organizational rail logistics concept to other modes of transport; • knows the role of railways in the global transport system
<p>Topics of the subject</p>	<p>Role of Railway in Transport System</p> <ul style="list-style-type: none"> - role of transport in whole economy - role of rail transport in supply chain management - comparison of transport modes - rail transport and railway system - cost-benefit analysis of transport modes <p>The Role of Railway Transport in the Intermodal Chain</p> <ul style="list-style-type: none"> - transport technology for the co-modal chain

	<ul style="list-style-type: none"> - multi- and intermodal transportation - intermodal shipments - documentation and freight forwarding <p>Real-Time Path Coordination, Tracking, and Information Systems</p> <ul style="list-style-type: none"> - information and path coordination system - real-time monitoring systems for freight (tracking and tracing) - documentation and billing systems <p>Standards</p> <ul style="list-style-type: none"> - standards for rolling stock - standards for transport services - environmental standards
2.Implementation of Policy and Regulations in the Rail Transport	3 credit points
General objective	To orientate in international legislative and technical regulations and in their national applications
Learning outcomes	<p>The student:</p> <ul style="list-style-type: none"> • knows the international trends in rail transport; • knows process of creating international law and the fundamentals of national applications; • knows international legal and recommended regulations; • is able to find the limits imposed in railway transport
Topics of the subject	<p>New Generation of Rail Vehicles and Smart Infrastructure</p> <p>The Influence of Regulations in Rail Transportation</p> <ul style="list-style-type: none"> - enabling cross-border actions - shared best practices - transitional difficulties <p>Legal Basis</p> <ul style="list-style-type: none"> - directives

	<ul style="list-style-type: none"> - EU regulations - national law <p>Technical Specifications for Interoperability</p> <ul style="list-style-type: none"> - infrastructure - resources for organising the transportation, freight - communication <p>Agreements</p> <ul style="list-style-type: none"> - COTIF freight area - SMGS freight area - compatibility and exceptions in agreements <p>Legislation and Supervision</p> <ul style="list-style-type: none"> - law-making - statistics and reporting obligations - supervision
3. Railway Freight Operations and Management	3 credit points
Objective	To provide an overview of the cooperation of railway companies in organizing rail freight
Learning outcomes	<p>The student:</p> <ul style="list-style-type: none"> • knows the railway companies, the nature and foundations of cooperation; • knows the design basis for the service and quality assurance processes; • knows the international rail transport logistic processes; • knows the safety of railway traffic and railway freight transportation; • is able to carry out risk analysis, develop preventive systems of hazardous situations and compile process descriptions for contingencies

<p>Topics of the subject</p>	<p>Railway System</p> <ul style="list-style-type: none"> - the railway companies (undertakers -RU) - railway infrastructure managers (IM) - supporting entrepreneurship for railway <p>Services and Quality</p> <ul style="list-style-type: none"> - basic and supporting services - service level and quality - open market and competition <p>Planning of International Transportation Operations</p> <ul style="list-style-type: none"> - international transportation line planning and scheduling - international co-operation - border crossing operations management <p>Safety and Security of Transportation Operations</p> <ul style="list-style-type: none"> - the requirements for loading and gauges - dangerous goods transport management - accident processing 	
<p>4. Railway Asset Management and Pricing</p> <p><i>Study material is in the form of the Deliverables</i></p> <p><i>3.2.1-5.1, prepared by Ott Koppel</i></p>	<p>3 credit points</p>	
<p>Objective</p>	<p>To give an overview of asset management and pricing</p>	
<p>Learning outcomes</p>	<p>The student:</p> <ul style="list-style-type: none"> • understands the common management model of railway assets; • understands the acquisition process and use of resources for asset management, taking into account the life-cycle costs, quality of service, rail traffic safety and the impact on the surrounding environment; • is acquainted with railway legal environment, including cross-border agreements, can implement them in his 	

	vocational and professional activities	
Topics of the subject	<p>Rail management</p> <ul style="list-style-type: none"> - rail transport - assets of railway undertakings - organizing of railway assets <p>Pricing</p> <p>a) cost accounting</p> <ul style="list-style-type: none"> * classification of railway transport costs * obligation to accounting organization at railway undertakings * cost accounting system of railway undertakings <p>b) calculation of prices</p> <ul style="list-style-type: none"> * basics for pricing formation * railway infrastructure access fee for basic service * charges of other infrastructure services * freight charge and tariffs applied * commercial services fees of administration of railways 	
5. Environment and Cross-Border Resource Management in Rail Transport		3 credit points
	<i>Study materials are in the form of the deliverables</i>	
	3.2.1 - 5.2 to 3.2.1- 5.4	
Objective	To provide an overview of the railway transport from the environmental point of view and resource organization for cross-border activities.	
Learning outcomes	<p>The student:</p> <ul style="list-style-type: none"> • knows the environmental problems and possible solutions in the rail transport; • knows stock selection criteria and management principles; • knows train on-board personnel requirements; 	

	<ul style="list-style-type: none"> • knows the organization of cross-border hauling resources
<p>Topics of the subject</p>	<p>Cross-Border Resource Management in Rail Transport</p> <p>Rolling Stock Selection <i>(prepared by Martin Kuusk)</i></p> <ul style="list-style-type: none"> - locomotives - wagons - rolling stock and infrastructure interoperability with real-time systems <p>Training of Employees <i>(prepared by Rita Ojala)</i></p> <ul style="list-style-type: none"> - professional requirements - health requirements - co-operation and information transmitting capability <p>Rolling Stock Rotation <i>(prepared by Martin Kuusk)</i></p> <ul style="list-style-type: none"> - maintenance and repair schedules - scheduling of regular services - fuel and energy consumption <p>Crew Rotation</p> <ul style="list-style-type: none"> - work and rest time - turning point workflow management - border crossing management <p>Green & Sustainable Rail Transportation <i>(by Viive Kirsipuu)</i></p> <ul style="list-style-type: none"> - environmental requirements for railway infrastructure - environmental requirements of railway rolling stock - environmental requirements for rail freight (dangerous goods)