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# **DEVELOPMENT OF EDUCATION MODULES FOR SAFETY CRITICAL RAILWAY OPERATION SYSTEMS**

**DEM-SaCROS**  
**2023**

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**DEVELOPMENT OF EDUCATION MODULES  
FOR RAIL SYSTEM CONSTRUCTION**



**EDUCATION MODULES  
FOR RAIL SYSTEM CONSTRUCTION**

**DEM-SaCROS  
2023**





**DEVELOPMENT OF EDUCATION MODULES  
FOR RAIL SYSTEM CONSTRUCTION**



**COURSE CONTENTS**  
-  
**LEARNING OUTCOMES**





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b>	<b>RAIL SYSTEM MANAGEMENT</b>
<b>COURSE CODE AND TITLE</b>	<b>RAIL SYSTEM CONSTRUCTION</b>
<b>COURSE SEMESTER</b>	<b>RAIL SYSTEM ELECTRIC ELECTRONICS</b>
<b>WEEKLY COURSE PERIOD</b>	
<b>COURSE DURATION</b>	<b>MATHEMATICS I</b>

### **AIMS**

1. To be able to do mathematical operations concerning accounting number, natural numbers, integers, rational numbers and irrational numbers.
2. To be able to express the basic identities to solve an equation.
3. To be able to explain the function
4. To be able to explain logarithm
5. To be able to understand and explain trigonometry
6. To be able to calculate the area and volume of different geometries

### **SPECIAL DEFINITIONS**

In order to increase the student's, mathematical skills which would be necessary to improve the analytical and geometrical understanding of them, basic mathematical operations, identities and equations would be introduced. Besides, the further information regarding the geometry and trigonometry will improve the rational thinking skills of the students.

### **EVAULATION TABLE**

The percentages of the studies conducted related to topic and teaching style are given according to their weights in the table below. While final exam questions preparing, this percentage shall be considered.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Mathematical operations concerning accounting number, natural numbers, integers, rational numbers and irrational numbers.	20
B. The basic identities to solve an equation	15
C. Function	20
D. Logarithm	15
E. Trigonometry	15
F. Area and Volume	15





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### **TOPICS**

**A. Workplace Management & Administration Mathematical operations concerning accounting number, natural numbers, integers, rational numbers and irrational numbers.**

**AIM:** To be able to do mathematical operations concerning accounting number, natural numbers, integers, rational numbers and irrational numbers.

#### **LEARNING OUTCOMES**

1. Do arithmetic operations concerned rational and irrational numbers .
2. Recognize exponentiation numbers that come out and practice operations.
3. Recognize arithmetic operations with radical numbers
4. Recognize absolute value.

**B. The basic identities to solve an equation**

**AIM:** To be able to express the basic identities to solve an equation.

#### **LEARNING OUTCOMES**

1. factorize quadratic equation.
2. Solve rational statement.
3. Solve equation
4. Recognize absolute value.

**C. Function**

**AIM:** To be able to explain function

#### **LEARNING OUTCOMES**

1. Define function concept.
2. Find out domain.
3. Find out inverse of function.
4. Plot function.

**D. Logarithm**

**AIM:** To be able to explain logarithm

#### **LEARNING OUTCOMES**

1. Define exponential functions and graph.
2. Define logarithm function.
3. Define natural logarithm.
4. express features of logarithm.

**E. Trigonometry**

**AIM:** To be able to understand and explain trigonometry

#### **LEARNING OUTCOMES**





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



1. Recognize an angle measure unity.
2. Set ratios of sine, cosine and tangent for acute angle.
3. Know inverse trigonometric ratios.
4. Graph trigonometry function.

### ***F. Area and Volume***

**AIM:** To be able to calculate the area and volume of different geometries

### ***LEARNING OUTCOMES***

1. calculate area and volume of geometric figure.
2. Apply euclidean and Pythagorous' theorems.
3. Calculate areas of irregular geometric figures.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



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<b>COURSE CODE AND TITLE</b>	<b>RAIL SYSTEM CONSTRUCTION</b>
<b>COURSE SEMESTER</b>	<b>RAIL SYSTEM ELECTRIC ELECTRONICS</b>
<b>WEEKLY COURSE PERIOD</b>	
<b>COURSE DURATION</b>	<b>MATHEMATICS II</b>

### AIMS

1. To be able to do matrices and determinants
2. To be able to do solutions of linear systems of equations
3. To be able to explain the integral
4. To be able to explain definition of derivative
5. To be able to understand and explain exponential and logarithmic functions
6. To be able to understand solutions of linear systems of equations

### SPECIAL DEFINITIONS

In order to increase the student's, mathematical skills which would be necessary to improve the analytical and geometrical understanding of them matrices and determinants, solutions of linear systems of equations, the integral, definition of derivative, exponential and logarithmic functions and linear systems of equations.

### EVAULATION TABLE

The percentages of the studies conducted related to topic and teaching style are given according to their weights in the table below. While final exam questions preparing, this percentage shall be considered.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Matrices and Determinants	20
B. Solutions of Linear Systems of Equations	15
C. Integral	20
D. Derivative, Definition of derivative	15
E. Exponential and Logarithmic Functions	15
F. Solutions of Linear Systems of Equations	15

### TOPICS

#### A. *Mathematical operations concerning matrices and determinants.*

**AIM:** To be able to do mathematical operations concerning matrices and determinants.

#### LEARNING OUTCOMES

1. Do arithmetic operations concerning matrices.
2. Do arithmetic operations concerning determinants.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### ***B. Solutions of Linear Systems of Equations***

**AIM:** To be able to do the solutions of linear systems of equations.

#### ***LEARNING OUTCOMES***

1. Solve equations.

### ***C. Integral***

**AIM:** To be able to understand integral

#### ***LEARNING OUTCOMES***

1. Define integral.
2. Find out definite integral.
3. Find out indefinite integral.
4. Understand properties of integral.

### ***D. Derivative***

**AIM:** To be able to explain definition of derivative

#### ***LEARNING OUTCOMES***

1. Define tangent line, properties of the derivative.
2. Define chain rule.
3. Define derivatives of polynomial, rational, exponential and logarithmic functions.

### ***E. Exponential and Logarithmic Functions***

**AIM:** To be able to understand and explain exponential and logarithmic functions

#### ***LEARNING OUTCOMES***

1. Find out exponential and logarithmic functions.

### ***F. Solutions of Linear Systems of Equations***

**AIM:** To be able to understand solutions of linear systems of equations.

#### ***LEARNING OUTCOMES***

1. Find out linear systems of equations.







## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b>	<b>RAIL SYSTEM MANAGEMENT</b>
<b>COURSE CODE AND TITLE</b>	<b>RAIL SYSTEM ELECTRIC ELECTRONICS</b>
<b>COURSE SEMESTER</b>	<b>RAIL SYSTEM CONSTRUCTION</b>
<b>WEEKLY COURSE PERIOD</b>	
<b>COURSE DURATION</b>	<b>TECHNICAL DRAWING</b>

### AIMS

1. Teach students the basic principles of technical drawing, such as line types, lettering, and dimensioning.
2. Help students develop their skills in sketching and drafting.
3. Enable students to communicate their ideas clearly and concisely through technical drawings.
4. Prepare students for careers in engineering and other fields where technical drawing is a necessary skill.

### SPECIAL DEFINITION

**Problem-solving:** Technical drawing requires the ability to solve problems and think critically. Students will learn how to use their technical drawing skills to solve problems and come up with creative solutions. **Communication:** Technical drawings are a form of communication. Students will learn how to use their technical drawing skills to communicate their ideas clearly and concisely to others. **Teamwork:** Technical drawings are often created by teams of people. Students will learn how to work effectively as part of a team to create technical drawings.

### EVAULATION TABLE

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Engineering Drawing and Tools	30
B. Geometric Projection and Drawing Views	30
C. Scaling and Measuring	40

### TOPICS

#### A. Engineering Drawing and Tools

**AIM:** Students know details of engineering drawing and tools.

#### LEARNING OUTCOMES

1. Knows papers used at drawing and other tools.





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2. Know measurements of paper standards.

### ***B. Geometric Projection and Drawing Views***

**AIM:** Knows scaling and measuring, cross section views, perspective, roughness of surfaces and surface processing signs, tolerance and exercises.

#### ***LEARNING OUTCOMES***

1. Students can draw cross section views, perspective and tolerance.
2. Students can define roughness of surfaces and surface processing signs.

### ***C. Scaling and Measuring***

**AIM:** To know scaling and measuring of parts.

#### ***LEARNING OUTCOMES***

1. Students can understand and draw scaling and measuring tools.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b>	<b>RAIL SYSTEM MANAGEMENT</b>
<b>COURSE CODE AND TITLE</b>	<b>RAIL SYSTEM CONSTRUCTION</b>
<b>COURSE SEMESTER</b>	
<b>WEEKLY COURSE PERIOD</b>	<b>INTRODUCTION TO RAILWAY</b>
<b>COURSE DURATION</b>	<b>TRANSPORTATION</b>

### **AIMS**

1. Provide students with a basic understanding of the history, components, and operation of railway transportation systems.
2. Help students develop an appreciation for the importance of railway transportation in the global economy.
3. Encourage students to consider careers in the railway transportation industry.

### **SPECIAL DEFINITION**

By learning about railway transportation, students can gain a better understanding of this important mode of transportation. They can also develop an appreciation for the challenges and opportunities facing the railway transportation industry. This knowledge can help students make informed decisions about their future careers.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Importance, role and classification of railroad transportation, features of trains, locomotives and wagoons	30
B. Operations of trains, safety and communications systems	30
C. Infrastructure and superstructure on railways	40

### **TOPICS**

- A. *Understands the importance, role and classification of railroad transportation, features of trains, locomotives and wagoons*

**AIM:** To be able to understand importance, role and classification of railroad transportation, features of trains, locomotives and wagoons

### **LEARNING OUTCOMES**

1. Define the importance of different types of rail road vehicles.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



2. Knows the features of trains, locomotives and wagoons

### ***B. Operations of trains, safety and communications systems***

**AIM:** To be able to know operations of trains, safety and communications systems

#### **LEARNING OUTCOMES**

1. Understands operations of rail vehicles.
2. Knows about safety and communications systems.

### ***C. Infrastructure and superstructure on railways***

**AIM:** To be able to understand infrastructure and superstructure on railways

#### **LEARNING OUTCOMES**

1. Understands the infrastructure and superstructure especially switches, basics of railroad projects and track maintenance.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b> <b>COURSE CODE AND TITLE</b> <b>COURSE SEMESTER</b> <b>WEEKLY COURSE PERIOD</b> <b>COURSE DURATION</b>	<b>RAIL SYSTEM CONSTRUCTION</b> <b>STATICS STRENGTH OF MATERIAL</b>
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### **AIMS**

1. To comprehend the basics of Newtonian mechanics.
2. The ability to apply equilibrium conditions – support reactions and internal forces.
3. To identify statically determinate and indeterminate systems.
4. The ability to compute the axial, shear, and bending stresses; stress in an inclined plane – Mohr’s circle.
5. The ability to compute the deflection and elastic stability of members.
6. To comprehend the brittle and ductile responses – fatigue of components and structures.

### **SPECIAL DEFINITION**

Students understand the basic principles and axioms of Newtonian mechanics. They can independently apply equilibrium conditions and analyse structural systems. Students can assess the degree of indeterminacy in a structural system. They can investigate a section's internal stresses and strains in the elastic field. Students gain the pre-design philosophy by analysing the structural behaviour. Homeworks and semester projects are a part of the course to increase their orientation in the field of statics and the strength of materials.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Basics principles and axioms of Newtonian mechanics	10
B. Definition of support reactions, axial and shear force, moment, and equilibrium conditions	25
C. Statically determinate and indeterminate problems in beams, trusses, and frames	15
D. Stress and strain concept, Mohr’s circle	20
E. Deflection of members and elastic stability	15
F. Brittle and ductile responses	15





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### TOPICS

#### A. Basics principles and axioms of Newtonian mechanics

**AIM:** To comprehend the basics of Newtonian mechanics.

##### LEARNING OUTCOMES

1. Understands the fundamental concepts of Newton's laws.
2. Understands the principle of structural idealisation.

#### B. Definition of support reactions, axial and shear force, moment, and equilibrium conditions

**AIM:** The ability to apply equilibrium conditions – support reactions and internal forces.

##### LEARNING OUTCOMES

1. Applies equilibrium of rigid bodies and draws free-body diagrams.
2. Determines unknown reactions.
3. Solves structural systems for determination of internal forces.

#### C. Statically determinate and indeterminate problems in beams, trusses, and frames

**AIM:** To identify statically determinate and indeterminate systems.

##### LEARNING OUTCOMES

1. Identifies determinacy of statically determinate, statically indeterminate and unstable structural systems.
2. Designs a structure modification to increase/decrease the statical determinacy of the system.

#### D. Stress and strain concept, Mohr's circle

**AIM:** The ability to compute the axial, shear, and bending stresses; stress in an inclined plane – Mohr's circle.

##### LEARNING OUTCOMES

1. Applies Hooke's law.
2. Evaluates the axial, shear and bending stresses.
3. Calculates the stresses in an inclined plane using Mohr's circle principle.

#### E. Deflection of members and elastic stability

**AIM:** The ability to compute the deflection and elastic stability of members.

##### LEARNING OUTCOMES

1. Computes member deflections.
2. Checks the elastic stability of a member.
3. Calculates the critical load in a buckled member.

#### F. Brittle and ductile responses

**AIM:** To comprehend the brittle and ductile responses – fatigue of components and structures.

##### LEARNING OUTCOMES

1. Identifies the brittle and ductile failures of material.
2. Knows the mechanism of fracture of materials.
3. Understands the fatigue concept.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b>	<b>RAIL SYSTEM MANAGEMENT</b>
<b>COURSE CODE AND TITLE</b>	<b>RAIL SYSTEM CONSTRUCTION</b>
<b>COURSE SEMESTER</b>	<b>RAIL SYSTEM ELECTRIC ELECTRONICS</b>
<b>WEEKLY COURSE PERIOD</b>	
<b>COURSE DURATION</b>	<b>RAILWAY SYSTEM TRAFFIC</b>

### **AIMS**

1. To introduce students to the basics of railway traffic management. This includes topics such as train signaling, train dispatching, and railway safety.
2. To help students develop the skills needed to analyze and solve railway traffic problems. This includes the ability to identify and assess risks, develop and implement safety procedures, and manage train traffic in a safe and efficient manner.
3. To encourage students to consider careers in the railway industry. The railway industry is a growing sector with a wide range of career opportunities. By learning about railway traffic management, students can gain the skills and knowledge needed to pursue a rewarding career in this field.

### **SPECIAL DEFINITION**

Train signaling: This includes the different types of train signals, how they work, and how they are used to control train movements. Train dispatching: This includes the process of planning and coordinating train movements, as well as the role of the train dispatcher. Railway safety: This includes topics such as railway signaling, train dispatching, and railway operations. Problem-solving: This includes the ability to identify and assess risks, develop and implement safety procedures, and manage train traffic in a safe and efficient manner.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Information about trains and other railway vehicles, signs and signals in railways	30
B. Regulations and crisis management in breakdowns and disorders	30
C. Classification of railway vehicles, preparation of trains for departures and regulations for railway traffic	40

### **TOPICS**





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### ***A. Understands information about trains and other railway vehicles, signs and signals in railways***

**AIM:** To understand information about trains and other railway vehicles, signs and signals in railways

#### **LEARNING OUTCOMES**

1. To be able to understand information about trains and other railway vehicles.
2. To know about signs and signals in railways.

### ***B. Regulations and crisis management in breakdowns and disorders***

**AIM:** To know regulations and crisis management in breakdowns and disorders

#### **LEARNING OUTCOMES**

1. Understand and know regulations and crisis management in breakdowns and disorders

### ***C. Classification of railway vehicles, preparation of trains for departures and regulations for railway traffic***

**AIM:** To recognize classification of railway vehicles, preparation of trains for departures and regulations for railway traffic

#### **LEARNING OUTCOMES**

1. Understands the classification of railway vehicles, preparation of trains for departures and regulations for railway traffic







## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b> <b>COURSE CODE AND TITLE</b> <b>COURSE SEMESTER</b> <b>WEEKLY COURSE PERIOD</b> <b>COURSE DURATION</b>	<b>RAIL SYSTEM CONSTRUCTION</b> <b>CONSTRUCTION MATERIALS</b>
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### **AIMS**

1. To understand the properties of construction materials.
2. The ability to perform tests of aggregate – physical and chemical.
3. To understand the principles of cementitious binders (grout, mortar, cement).
4. The ability to perform tests of fresh and hardened concrete.
5. To understand the principles of petroleum-based binders (bitumen).
6. To have a detailed overview of steel and timber.

### **SPECIAL DEFINITION**

Students understand the physical and chemical properties of construction materials. They are aware of a variety of construction materials available for construction. The students gain the ability to classify the aggregates and perform aggregate tests to determine the properties of the tested materials. They understand the principles of cementitious and petroleum-based binders. The students are able to perform tests of fresh concrete, such as consistency test, air content test, and specific gravity test, and tests of hardened concrete, such as compressive and tensile strength test, elastic modulus test, and permeability test. They have a good knowledge of the properties of steel and timber.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Properties of construction materials	15
B. Aggregate tests	25
C. Principles of cementitious binders	10
D. Fresh and hardened concrete tests	10
E. Principles of petroleum-based binders	10
F. Steel and timber	30





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### TOPICS

#### A. Properties of construction materials

**AIM:** To understand the properties of construction materials.

#### LEARNING OUTCOMES

1. Knows the basic terms, structures and properties of construction materials.
2. Classifies construction materials.

#### B. Aggregate tests

**AIM:** The ability to perform tests of aggregate – physical and chemical.

#### LEARNING OUTCOMES

1. Performs sieve analysis test, specific gravity test and water absorption test.
2. Performs basic tests of chemical properties.
3. Evaluates the results of the tests.

#### C. Principles of cementitious binders

**AIM:** To understand the principles of cementitious binders (grout, mortar, cement).

#### LEARNING OUTCOMES

1. Knows the types of cementitious binders.
2. Identifies the areas of use of the cementitious binders.

#### D. Fresh and hardened concrete tests

**AIM:** The ability to perform tests of fresh and hardened concrete.

#### LEARNING OUTCOMES

1. Performs consistency test, air content test, and specific gravity test in fresh concrete.
2. Performs compressive and tensile strength tests, elastic modulus test, and permeability test in hardened concrete.
3. Evaluates the results of the tests.

#### E. Principles of petroleum-based binders

**AIM:** To understand the principles of petroleum-based binder (bitumen).

#### LEARNING OUTCOMES

1. Knows the physical properties of asphalt cement and emulsions.
2. Understands the functions of petroleum-based binders in the field of railway engineering.

#### F. Steel and timber

**AIM:** To have a detailed overview of steel and timber.

#### LEARNING OUTCOMES

1. Knows the physical properties of steel and timber.
2. Characterises the mechanical properties of timber.
3. Performs and evaluates tensile test of structural steel.
4. Performs and evaluates timber tests.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b>	<b>RAIL SYSTEM CONSTRUCTION</b>
<b>COURSE CODE AND TITLE</b>	<b>SOIL MECHANICS</b>
<b>COURSE SEMESTER</b>	
<b>WEEKLY COURSE PERIOD</b>	
<b>COURSE DURATION</b>	

### **AIMS**

1. To understand the geotechnical properties of soils.
2. The ability to classify soil.
3. To determine consolidation and immediate settlement.
4. The ability to determine the bearing capacity and shear strength of the soil.
5. To comprehend lateral earth pressure and slope stability.
6. To understand soil compaction.

### **SPECIAL DEFINITION**

Students understand the geotechnical properties of soils. They are able to identify various types of soils, soil composition, grain size distribution, and weight-volume relationship. Students are aware of soil classification systems available in various standards. They calculate compression deformations in soil particles in two broad categories, such as consolidation and immediate settlement. Students determine the bearing capacity and shear strength of the soil. They calculate the active and passive lateral pressure required for earth-retaining structures. Students assess slope stability. They measure the degree of compaction and increment of bearing capacity in compacted soil.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Geotechnical properties of soils	15
B. Soil classification	25
C. Consolidation and immediate settlement	10
D. Bearing capacity and shear strength of soil	10
E. Lateral earth pressure and slope stability	10
F. Soil compaction	30





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### TOPICS

#### A. *Geotechnical properties of soils*

**AIM:** To understand the geotechnical properties of soils.

#### **LEARNING OUTCOMES**

1. Knows the basic terms and properties of soils.
2. Describes the soil composition.

#### B. *Soil classification*

**AIM:** The ability to classify soil.

#### **LEARNING OUTCOMES**

1. Knows various soil classification systems.
2. Classifies soils.
3. Knows basic tests to find soil properties.

#### C. *Consolidation and immediate settlement*

**AIM:** To determine consolidation and immediate settlement.

#### **LEARNING OUTCOMES**

1. Performs consolidation tests.
2. Calculates immediate settlements.
3. Calculates the stress states of soil.

#### D. *Bearing capacity and shear strength of soil*

**AIM:** The ability to determine the bearing capacity and shear strength of the soil.

#### **LEARNING OUTCOMES**

1. Knows the Mohr-Coulomb failure criteria.
2. Performs direct shear tests.
3. Calculates the bearing capacity of various soil types.

#### E. *Lateral earth pressure and slope stability*

**AIM:** To comprehend lateral earth pressure and slope stability.

#### **LEARNING OUTCOMES**

1. Calculates the earth pressure at rest.
2. Assesses the soil stability of unrestraint slopes.

#### F. *Soil compaction*

**AIM:** To understand soil compaction.

#### **LEARNING OUTCOMES**

1. Knows the general principles and needs of soil compaction.
2. Performs standard Proctor test.
3. Evaluates the Proctor test results.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b>	<b>RAIL SYSTEM MANAGEMENT</b>
<b>COURSE CODE AND TITLE</b>	<b>RAIL SYSTEM CONSTRUCTION</b>
<b>COURSE SEMESTER</b>	
<b>WEEKLY COURSE PERIOD</b>	<b>URBAN RAILWAY TRANSPORTATION</b>
<b>COURSE DURATION</b>	<b>SYSTEMS I</b>

### **AIMS**

1. To introduce students to the basics of urban railway transportation. This includes topics such as the history of urban railways, the different types of urban railways, and the role of urban railways in a city's transportation system.
2. To help students develop an understanding of the challenges and opportunities facing urban railway transportation. This includes topics such as funding, planning, construction, operation, and maintenance of urban railways.

### **SPECIAL DEFINITION**

History of urban railways: This includes the history of urban railways in different parts of the world, as well as the factors that have contributed to the growth of urban railways. Types of urban railways: This includes the different types of urban railways, such as light rail, heavy rail, and metro. Role of urban railways in a city's transportation system: This includes the role of urban railways in providing transportation for commuters, tourists, and other city residents. Challenges and opportunities facing urban railway transportation: This includes topics such as funding, planning, construction, operation, and maintenance of urban railways.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. General definitions and concepts about urban railway transportation systems	30
B. Importance and kinds of urban railway transportation systems and planning of these systems; defining the vehicles used in these systems	30
C. Signs and signals for the information processing system	40

### **TOPICS**

- A. General definitions and concepts about urban railway transportation systems**

**AIM:** To understand general definitions and concepts about urban railway transportation systems

### **LEARNING OUTCOMES**

1. Knows general definitions and concepts about urban railway transportation systems.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### ***B. Importance and kinds of urban railway transportation systems and planning of these systems; defining the vehicles used in these systems***

**AIM:** To know importance and kinds of urban railway transportation systems and planning of these systems, defining the vehicles used in these systems.

#### **LEARNING OUTCOMES**

1. Understands importance and kinds of urban railway transportation systems and planning of these systems
2. Defines the vehicles used in these systems.

### ***C. Signs and signals for the information processing system***

**AIM:** To recognize and know sign and signals for the information processing system

#### **LEARNING OUTCOMES**

1. Understands sign and signals for the information processing system.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b>	<b>RAIL SYSTEM MANAGEMENT</b>
<b>COURSE CODE AND TITLE</b>	<b>RAIL SYSTEM CONSTRUCTION</b>
<b>COURSE SEMESTER</b>	
<b>WEEKLY COURSE PERIOD</b>	<b>URBAN RAILWAY TRANSPORTATION</b>
<b>COURSE DURATION</b>	<b>SYSTEMS II</b>

### **AIMS**

1. To encourage students to consider careers in the urban railway transportation industry. The urban railway transportation industry is a growing sector with a wide range of career opportunities. By learning about urban railway transportation, students can gain the skills and knowledge needed to pursue a rewarding career in this field. Students can focus on type, class and speed of trains used in urban railway transportation systems and planning of traffic and rules of the regulation.

### **SPECIAL DEFINITION**

**Sustainability:** Urban railways can be a more sustainable form of transportation than other modes, such as cars and buses. This is because they can carry more people per unit of energy, and they do not produce emissions that contribute to air pollution or climate change. **Safety:** Urban railways can be made safer for passengers and operators by using a variety of safety measures, such as automatic train control (ATC), positive train control (PTC), and wayside signaling. **Technology:** The latest technologies that are being used in urban railways include driverless trains and smart ticketing. Driverless trains are controlled by a computer system, which can improve safety and efficiency.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Type, class and speed of trains used in urban railway transportation systems	30
B. Facilities providing the safety of control systems	30
C. Maintenance and repair of these facilities preparing all vehicle	40

### **TOPICS**

**A. Type, class and speed of trains used in urban railway transportation systems**

**AIM:** To understand type, class and speed of trains used in urban railway transportation systems

### **LEARNING OUTCOMES**

1. Knows general type, class and speed of trains used in urban railway transportation systems.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### ***B. Facilities providing the safety of control systems***

**AIM:** To know facilities providing the safety of control systems

#### ***LEARNING OUTCOMES***

1. Understands importance of facilities providing the safety of control systems.

### ***C. Maintenance and repair of these facilities preparing all vehicle***

**AIM:** To know maintenance and repair of these facilities preparing all vehicle

#### ***LEARNING OUTCOMES***

1. Understands maintenance and repair of these facilities preparing all vehicle.







## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b> <b>COURSE CODE AND TITLE</b> <b>COURSE SEMESTER</b> <b>WEEKLY COURSE PERIOD</b> <b>COURSE DURATION</b>	<b>RAIL SYSTEM CONSTRUCTION</b> <b>INFRASTRUCTURE AND MAINTENANCE</b>
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### **AIMS**

1. To apprehend the structural and geometric parameters of track.
2. The ability to calculate horizontal and vertical alignments of track.
3. The knowledge of railway substructure and superstructure.
4. To comprehend the design of turnouts.
5. To identify railway station types and their functions.
6. To comprehend the maintenance procedures of railway tracks.

### **SPECIAL DEFINITION**

Students are acquainted with the structural and geometric parameters of track. They are able to calculate horizontal and vertical alignments of track. Students recognise railway substructure and superstructure and identify their structural layers. They are aware of turnout types, the design principles of turnouts and the use of turnouts in railway tracks. Students are able to identify railway station types and understand their function in a railway network. They recognise maintenance procedures used in the railway tracks. Homeworks and semester projects are a part of the course to increase their orientation in the field of infrastructure and maintenance.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratio of Topics (%)</b>
A. Structural and geometric parameters of track	15
B. Horizontal and vertical alignment of track	15
C. Railway substructure and superstructure	25
D. Railway turnouts	15
E. Railway stations types and functions	10
F. Maintenance of railway tracks	20





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### TOPICS

#### A. Structural and geometric parameters of track

**AIM:** To apprehend the structural and geometric parameters of track.

#### LEARNING OUTCOMES

1. Determines the track gauge, rail profiles, and geometric parameters of track.
2. Calculates and draws transition lines and transition curves.

#### B. Horizontal and vertical alignment of track

**AIM:** The ability to calculate horizontal and vertical alignments of track.

#### LEARNING OUTCOMES

1. Calculates and draws horizontal and vertical alignment of track.
2. Understands the routing principles of railway track.
3. Understands the concept of lost rise and route of constant resistance.

#### C. Railway substructure and superstructure

**AIM:** The knowledge of railway substructure and superstructure.

#### LEARNING OUTCOMES

1. Knows the construction layers of railway substructure and superstructure.
2. Calculates the loading capacity of railway substructure.
3. Recognises parts of railway superstructure.

#### D. Railway turnouts

**AIM:** To comprehend the design of turnouts.

#### LEARNING OUTCOMES

1. Identifies parts of turnouts.
2. Understands the working principles of turnouts.
3. Draws the turnout design within the track.

#### E. Railway stations types and functions

**AIM:** To identify railway station types and their functions.

#### LEARNING OUTCOMES

1. Identifies railway station types.
2. Understands the functions of railway station parts.
3. Draws track scheme of a railway station.

#### F. Maintenance of railway tracks

**AIM:** To comprehend the maintenance procedures of railway tracks.

#### LEARNING OUTCOMES

1. Is acquainted with track mechanisation.
2. Understands the principles of maintenance works on railway tracks.
3. Identifies economic benefits of railway track maintenance.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b>	<b>RAIL SYSTEM CONSTRUCTION</b>
<b>COURSE CODE AND TITLE</b>	<b>ROAD MACHINES</b>
<b>COURSE SEMESTER</b>	
<b>WEEKLY COURSE PERIOD</b>	
<b>COURSE DURATION</b>	

### **AIMS**

1. To understand the repair and maintenance technology with track (rails, sleepers) removal.
2. To understand the repair and maintenance technology without track (rails, sleepers) removal.
3. To comprehend the principles of the use of excavators.
4. To comprehend the principles of the use of bulldozers.
5. To comprehend the principles of the use of graders.
6. To comprehend the principles of the use of rollers.

### **SPECIAL DEFINITION**

Students understand the repair and maintenance technology. In the case of repair and maintenance technology with track (rails, sleepers) removal, they differentiate between the technology of track removal in axis and track removal per track sections. Students know the working principles of construction machines used in substructure construction. They justify the usage areas of excavators, bulldozers, graders and rollers. Students assess the effective use of road machines in railway constructions.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Repair and maintenance technology with track (rails, sleepers) removal	30
B. Repair and maintenance technology without track (rails, sleepers) removal	30
C. Excavators	10
D. Bulldozers	10
E. Graders	10
F. Rollers	10





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### TOPICS

#### A. *Repair and maintenance technology with track (rails, sleepers) removal*

**AIM:** To understand the repair and maintenance technology with track (rails, sleepers) removal.

##### **LEARNING OUTCOMES**

1. Knows the suitable conditions for the use of the repair and maintenance technology with track (rails, sleepers) removal and is aware of the advantages and disadvantages of this technology.
2. Puts the procedure activities in order.
3. Assesses the time, workforce, machine and financial requirements of the work.

#### B. *Repair and maintenance technology without track (rails, sleepers) removal*

**AIM:** To understand the repair and maintenance technology without track (rails, sleepers) removal.

##### **LEARNING OUTCOMES**

1. Knows the suitable conditions for the use of the repair and maintenance technology without track (rails, sleepers) removal and is aware of the advantages and disadvantages of this technology.
2. Puts the procedure activities in order.
3. Assesses the time, workforce, machine and financial requirements of the work.

#### C. *Excavators*

**AIM:** To comprehend the principles of the use of excavators.

##### **LEARNING OUTCOMES**

1. Knows the working principles of excavators.
2. Follows safety rules related to excavators.

#### D. *Bulldozers*

**AIM:** To comprehend the principles of the use of bulldozers.

##### **LEARNING OUTCOMES**

1. Knows the working principles of bulldozers.
2. Follows safety rules related to bulldozers.

#### E. *Graders*

**AIM:** To comprehend the principles of the use of graders.

##### **LEARNING OUTCOMES**

1. Knows the working principles of graders.
2. Follows safety rules related to graders.

#### F. *Rollers*

**AIM:** To comprehend the principles of the use of rollers.

##### **LEARNING OUTCOMES**

1. Knows the working principles of rollers.
2. Follows safety rules related to rollers.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b> <b>COURSE CODE AND TITLE</b> <b>COURSE SEMESTER</b> <b>WEEKLY COURSE PERIOD</b> <b>COURSE DURATION</b>	<b>RAIL SYSTEM CONSTRUCTION</b> <b>BRIDGES AND TUNNELS</b>
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### **AIMS**

1. To comprehend the principles of bridge design.
2. To gain competence in the assessment of loads on bridges.
3. To identify bridge deck types and the purpose of individual load-bearing elements of bridges.
4. To get acquainted with the types of railway superstructure on bridges.
5. To identify various tunnelling methods.
6. To understand the purpose of railway superstructure elements in tunnels.

### **SPECIAL DEFINITION**

Students are aware of various bridge types (girder, frame, arch, suspension, cable-stayed). They specify their advantages and disadvantages and identify particular functioning elements of bridges and describe their purpose. Students calculate load acting on bridges and particular bridge elements. They classify bridge decks and identify load-bearing elements. Students know various types of railway superstructures applied onto bridges. They have a good command of tunnelling methods. Students draw a cross-section of a railway track in the tunnel and understand the purpose of particular superstructure elements used in tunnels.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Principles of bridge design	20
B. Loading of bridges	15
C. Bridge deck and load-bearing elements	15
D. Railway superstructure on bridges	10
E. Tunnelling methods	25
F. Railway superstructure in tunnels	15





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### TOPICS

#### A. Principles of bridge design

**AIM:** To comprehend the principles of bridge design.

#### LEARNING OUTCOMES

1. Classifies individual bridge types (girder, frame, arch, suspension, cable-stayed).
2. Identifies functioning elements of bridges and describes their purpose in the structure.
3. Draws structural clearances on and under a bridge.

#### B. Loading of bridges

**AIM:** To gain competence in the assessment of loads on bridges.

#### LEARNING OUTCOMES

1. Classifies various bridge load types.
2. Calculates internal forces in load-bearing bridge elements.
3. Calculates the loading capacity of a bridge.

#### C. Bridge deck and load-bearing elements

**AIM:** To identify bridge deck types and the purpose of individual load-bearing elements of bridges.

#### LEARNING OUTCOMES

1. Classifies bridge deck types.
2. Understands the purpose of individual load-bearing elements.
3. Draws and calculates the loading capacity of joints of bridge elements.

#### D. Railway superstructure on bridges

**AIM:** To get acquainted with the types of railway superstructure on bridges.

#### LEARNING OUTCOMES

1. Classifies bridge railway superstructure types.
2. Knows the advantages and disadvantages of individual railway superstructure types.
3. Draw technical details of bridge railway superstructure types.

#### E. Tunnelling methods

**AIM:** To identify various tunnelling methods.

#### LEARNING OUTCOMES

1. Knows a variety of tunnelling methods.
2. Is aware of particular steps of tunnelling work.
3. Understands the principles of ground arches.

#### F. Railway superstructure in tunnels

**AIM:** To understand the purpose of railway superstructure elements in tunnels.

#### LEARNING OUTCOMES

1. Draws structural clearances in tunnels.
2. Knows various railway superstructure types in tunnels.
3. Understands the principles of safe railway operation in tunnels.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b> <b>COURSE CODE AND TITLE</b> <b>COURSE SEMESTER</b> <b>WEEKLY COURSE PERIOD</b> <b>COURSE DURATION</b>	<b>RAIL SYSTEM CONSTRUCTION</b> <b>SUPERSTRUCTURE      TECHNIQUE      AND</b> <b>MAINTENANCE</b>
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### **AIMS**

1. To have a good command of rails and rail fastening.
2. To have a good command of sleepers.
3. To know the composition of track structure.
4. To have an overview of track types.
5. To understand the principles of turnout.
6. To familiarize with track maintenance procedures.

### **SPECIAL DEFINITION**

Students know the available rail types and production lengths. They identify rail defects. Students are aware of available fastening types and the purpose of particular fastening elements. They differentiate between rigid and elastic fastening. Students identify sleepers of various materials and types. They understand their purpose in the track. Students know the track structure design. They understand the purpose of each track structure layer. Students understand the difference between ballasted and slab track. They understand the working principles of turnouts. Students describe turnout elements. They are aware of track maintenance cycles and track quality parameters. Students know the procedures to maintain individual elements of a railway track.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Rails and rail fastening	20
B. Sleepers	15
C. Track structure	20
D. Types of track	15
E. Turnouts	15
F. Track maintenance	15





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### TOPICS

#### A. Rails and rail fastening

**AIM:** To have a good command of rails and rail fastening.

#### LEARNING OUTCOMES

1. Knows available rail profiles, rail lengths and their production process.
2. Identifies rail defects.
3. Knows rail fastening types and differentiates between rigid and elastic rail fastening.

#### B. Sleepers

**AIM:** To have a good command of sleepers.

#### LEARNING OUTCOMES

1. Identifies sleepers based on their material and type.
2. Knows the purpose of sleepers in track.
3. Designs sleeper spacing.

#### C. Track structure

**AIM:** To know the composition of track structure.

#### LEARNING OUTCOMES

1. Knows particular track structure layers.
2. Understands the reinforcement of the track formation.
3. Designs track structure composition.

#### D. Types of track

**AIM:** To have an overview of track types.

#### LEARNING OUTCOMES

1. Differentiate between ballasted track and slab track.
2. Is able to create ballasted track and slab track designs.
3. Knows the advantages and disadvantages of slab track.

#### E. Turnouts

**AIM:** To understand the principles of turnout.

#### LEARNING OUTCOMES

1. Understands the purpose of turnouts in track and the working principles of turnouts.
2. Identifies turnout elements.
3. Draws a turnout design.

#### F. Track maintenance

**AIM:** To familiarize with track maintenance procedures.

#### LEARNING OUTCOMES

1. Knows the track maintenance cycles.
2. Knows the track quality parameters and their limit values.
3. Knows track maintenance principles.







## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b>	<b>RAIL SYSTEM CONSTRUCTION</b>
<b>COURSE CODE AND TITLE</b>	<b>RAIL WELDING</b>
<b>COURSE SEMESTER</b>	
<b>WEEKLY COURSE PERIOD</b>	
<b>COURSE DURATION</b>	

### **AIMS**

1. To have an overview of stresses in rails.
2. To comprehend the theory of continuous welded rail.
3. To understand the principle of neutral temperature.
4. To know rail length adjusting procedures.
5. To have a good command of rail welding methods.
6. To know the principles of quality checks of rail welds.

### **SPECIAL DEFINITION**

Students know stresses acting in rails. They understand the causation of the stresses and conditions under which they act. Students assess the magnitude of particular stresses and the volume of the total stress in rails under various conditions. They know the theory of continuous welded rail and understand the principles of its stability. Students are familiar with the use of neutral temperature. They select suitable rail length adjusting methods and apply them. Students have a good command of rail welding methods and their advantages and disadvantages. They are aware of the quality checks of continuous welded rail that can be performed.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Rail stresses	20
B. Continuous welded rail (CWR)	25
C. Neutral temperature	10
D. Adjusting the rail length	10
E. Rail welding methods	25
F. Quality checks of rail welds	10





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### TOPICS

#### A. Rail stresses

**AIM:** To have an overview of stresses in rails.

#### LEARNING OUTCOMES

1. Classifies stresses acting in rails.
2. Understands causation of the particular stresses.
3. Calculates the total stress in rails.

#### B. Continuous welded rail (CWR)

**AIM:** To comprehend the theory of continuous welded rail.

#### LEARNING OUTCOMES

1. Knows the theory of continuous welded rails.
2. Calculates the stability of continuous welded rail.
3. Identifies failures of continuous welded rail (rail breaks, track buckling) and their causation.

#### C. Neutral temperature

**AIM:** To understand the principle of neutral temperature.

#### LEARNING OUTCOMES

1. Understands the principles of the rail neutral temperature.
2. Calculates the neutral temperature of a rail.
3. Knows the factors that change the rail neutral temperature.

#### D. Adjusting the rail length

**AIM:** To know rail length adjusting procedures.

#### LEARNING OUTCOMES

1. Knows the methods of rail length adjusting.
2. Understands the conditions of rail stressing and destressing.
3. Calculates the length of the rail to be adjusted.

#### E. Rail welding methods

**AIM:** To have a good command of rail welding methods.

#### LEARNING OUTCOMES

1. Knows the principles of available rail welding methods.
2. Selects the suitable rail welding method for particular types of welds.
3. Follows the work safety during rail welding.

#### F. Quality checks of rail welds

**AIM:** To know the principles of quality checks of rail welds.

#### LEARNING OUTCOMES

1. Is acquainted with the principles of quality checks of rail welds.
2. Performs quality checks of rail welds.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b> <b>COURSE CODE AND TITLE</b> <b>COURSE SEMESTER</b> <b>WEEKLY COURSE PERIOD</b> <b>COURSE DURATION</b>	<b>RAIL SYSTEM CONSTRUCTION</b> <b>RAILROAD PROJECT AND RAILROAD</b> <b>TECHNIQUE</b>
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### **AIMS**

1. To know geometrical characteristics of railway track.
2. To calculate the horizontal alignment of railway track.
3. To calculate the vertical alignment of railway track.
4. To perform CAD-based design.
5. To understand the principles of building information modelling (BIM).
6. To prepare railway design documentation.

### **SPECIAL DEFINITION**

Students have a good knowledge of the geometric characteristics of railway track. They know the standard and limit values of the geometric parameters of track. Students calculate the horizontal and vertical alignment of railway track. They are capable of performing CAD-based design of railway track. Students have general information on the principles of building information modelling (BIM). They implement BIM in railway design projects. Students prepare all parts of railway design documentation.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Geometrical characteristics of railway track	25
B. Horizontal alignment	15
C. Vertical alignment	15
D. CAD systems	20
E. Building information modelling (BIM)	15
F. Railway design documentation	10





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### **TOPICS**

#### **A. Geometrical characteristics of railway track**

**AIM:** To know geometrical characteristics of railway track.

##### **LEARNING OUTCOMES**

1. Knows the rail profiles, inclination and nominal track gauge.
2. Calculates railway superelevation and superelevation ramps.
3. Calculates track gauge widening.

#### **B. Horizontal alignment**

**AIM:** To calculate the horizontal alignment of railway track.

##### **LEARNING OUTCOMES**

1. Calculates horizontal transition curve parameters.
2. Knows track routing principles.
3. Designs horizontal alignment of railway track.

#### **C. Vertical alignment**

**AIM:** To calculate the vertical alignment of railway track.

##### **LEARNING OUTCOMES**

1. Calculates vertical gradient change.
2. Designs vertical alignment of railway track.

#### **D. CAD systems**

**AIM:** To perform CAD-based design.

##### **LEARNING OUTCOMES**

1. Works in CAD software.
2. Models railway track in CAD environment.

#### **E. Building information modelling (BIM)**

**AIM:** To understand the principles of building information modelling (BIM).

##### **LEARNING OUTCOMES**

1. Knows the basic terms of BIM.
2. Works in a common data environment (CDE).
3. Creates BIM model of the structure.

#### **F. Railway design documentation**

**AIM:** To prepare railway design documentation.

##### **LEARNING OUTCOMES**

1. Knows the legislative background of railway design documentation.
2. Prepares final drawings.
3. Prepares bill of quantities and budget.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b> <b>COURSE CODE AND TITLE</b> <b>COURSE SEMESTER</b> <b>WEEKLY COURSE PERIOD</b> <b>COURSE DURATION</b>	<b>RAIL SYSTEM MANAGEMENT</b> <b>MAINTENANCE OF RAILWAY VEHICLES AND</b> <b>CERTIFICATION</b>
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### **AIMS**

1. To understand the basic concepts and application areas of Management Systems and their impact on maintenance management and productivity.
2. To comprehend the basic concepts, organizations and ECM regulations of railway vehicle maintenance management system and certification.
3. Associating the Entity in Charge of Maintenance and its responsibilities with the ECM functions.
4. To understand the ECM certification process.

### **SPECIAL DEFINITION**

With the MAINTENANCE OF RAILWAY VEHICLES AND CERTIFICATION course, students will be provided with knowledge and skills regarding the maintenance management and certification processes of railway vehicles. It is intended that students comprehend the duties of a maintenance organization regarding ECM regulations and practices. A technical visit will be organized to an Entity in charge of Maintenance and they will be informed on the job about the ECM functions and certification process. In order to practice, the course should be supported by homework, practices and knowledge.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Maintenance Management	10
B. Vehicle Maintenance Management	30
C. ECM Functions	40
D. ECM Certification Process	20

### **TOPICS**

#### **A. Maintenance Management**

**AIM:** To understand the basic concepts and application areas of Management Systems and their impact on maintenance management and efficiency.

#### **LEARNING OUTCOMES**

1. Recognizes management systems and application areas.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



2. Interprets the basic concepts such as accreditation, certification, system, process, procedure, function, qualification etc.
3. Explains the relationship between quality management system, maintenance management and productivity.

### ***B. Vehicle Maintenance Management***

**AIM:** To comprehend the basic concepts, organizations and ECM regulations of railway vehicle maintenance management system and certification.

#### ***LEARNING OUTCOMES***

1. Explains the national and international institutions and regulations regarding the maintenance and certification of railway vehicles.
2. Explains certification of entities in charge of maintenance (ECM) certification and requirements.
3. Explains the main actors, responsibilities and relationships in the ECM certification process.

### ***C. ECM Functions***

**AIM:** To link the Entity in charge of Maintenance and its responsibilities with ECM functions.

#### ***LEARNING OUTCOMES***

1. Evaluates the entity in charge of maintenance and its responsibilities.
2. Explains the management function.
3. Explains the maintenance development function.
4. Explains the fleet management function.
5. Explains the maintenance delivery function.
6. Evaluates the relationship between ECM functions.

### ***D. ECM Certification Process***

**AIM:** To understand the ECM certification process.

#### ***LEARNING OUTCOMES***

1. Describes the ECM certification process in general.
2. Knows the special requirements of the authority or approver.
3. Comprehends ECM documentation and application applications.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b> <b>COURSE CODE AND TITLE</b> <b>COURSE SEMESTER</b> <b>WEEKLY COURSE PERIOD</b> <b>COURSE DURATION</b>	<b>RAIL SYSTEM CONSTRUCTION</b> <b>GEOTECHNICS FOR ROADS</b>
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### **AIMS**

1. To get acquainted with subsurface exploration.
2. To understand available soil improvement techniques.
3. To design earth-retaining structures.
4. To design sheet piles.
5. To know the principles of braced cuts.
6. To understand the principles of reinforced earth structures.

### **SPECIAL DEFINITION**

Students are acquainted with subsurface exploration (reconnaissance and site investigation). They are aware of available soil improvement techniques and potential implementation areas. Students are capable of designing earth-retaining structures and sheet piles. They know the requirements of deep-ground excavations (braced cuts). Students understand the principles of reinforced earth structures. They implement the principles of reinforced earth structures in substructure construction.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Subsurface exploration	20
B. Soil improvement	20
C. Earth retaining structures	15
D. Sheet piles	15
E. Braced cuts	20
F. Reinforced earth structures	10





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### TOPICS

#### A. *Subsurface exploration*

**AIM:** To get acquainted with subsurface exploration.

#### **LEARNING OUTCOMES**

1. Collects preliminary information of the soil.
2. Runs reconnaissance inspection.
3. Makes site investigation.

#### B. *Soil improvement*

**AIM:** To understand available soil improvement techniques.

#### **LEARNING OUTCOMES**

1. Knows the general principles of soil compaction.
2. Differs soil stabilization techniques.
3. Implements advanced materials, such as geotextiles.

#### C. *Earth retaining structures*

**AIM:** To design earth-retaining structures.

#### **LEARNING OUTCOMES**

1. Computes active and passive lateral earth pressure.
2. Checks the stability of retaining walls.
3. Designs earth-retaining structures.

#### D. *Sheet piles*

**AIM:** To design sheet piles.

#### **LEARNING OUTCOMES**

1. Designs cantilever sheet pile walls.
2. Designs anchored cantilever sheet pile walls.

#### E. *Braced cuts*

**AIM:** To know the principles of braced cuts.

#### **LEARNING OUTCOMES**

1. Computes lateral earth pressure in braced cuts.
2. Designs various components of braced cuts.
3. Checks the stability of braced cuts.

#### F. *Reinforced earth structures*

**AIM:** To understand the principles of reinforced earth structures.

#### **LEARNING OUTCOMES**

1. Knows the failure modes.
2. Knows the principles of soil reinforcement.
3. Designs reinforced earth retaining walls.







## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b>	<b>RAIL SYSTEM MANAGEMENT</b>
<b>COURSE CODE AND TITLE</b>	<b>RAIL SYSTEM CONSTRUCTION</b>
<b>COURSE SEMESTER</b>	<b>RAIL SYSTEM ELECTRIC ELECTRONICS</b>
<b>WEEKLY COURSE PERIOD</b>	<b>SAFETY CRITICAL COMMUNICATION</b>
<b>COURSE DURATION</b>	

### **AIMS**

1. To evaluate the concept and conceptual aspect of safety critical communication.
2. To know the basic elements of safety critical communication and to associate it with the profession.
3. To comprehend the importance of speech rules and patterns in safety critical communication.
4. To communicate using effective communication skills.
5. To apprehend the basic communication errors and barriers.
6. To be able to work in accordance with team communication and teamwork and to manage work stress.

### **SPECIAL DEFINITION**

With the SAFETY CRITICAL COMMUNICATION course, students' awareness of safe working, effective communication, team communication and teamwork and corporate culture will be raised. At the same time, it is aimed to increase their morale and motivation towards the profession with exemplary practices they may encounter in their working life. In order to practice, the course should be supported by homework, practices and knowledge.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Safety Critical Communication and Its Importance	10
B. Key Elements of Safety Critical Communication	20
C. Speech Rules and Patterns	20
D. Effective Communication Skills	20
E. Communication Barriers	15
F. Collaboration in Communication and Managing Work Stress	15

### **TOPICS**

#### **A. Safety Critical Communication and Its Importance**

**AIM:** To evaluate the concept of safety critical communication and its conceptual aspect.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### **LEARNING OUTCOMES**

1. Defines safety critical tasks.
2. Explains the impact of safety critical communication on safety.
3. Evaluates the effect of safety critical communication on safety during the task.
4. Distinguishes between safety critical communication and everyday communication.

### **B. Key Elements of Safety Critical Communication**

**AIM:** To know the key elements of safety critical communication and to associate it with the profession.

### **LEARNING OUTCOMES**

1. Lists the stages of safety critical communication.
2. Carries out the profession in accordance with the key elements of safety critical communication.
3. Explains the necessity of individual responsibility and leadership responsibility in communication.
4. Embraces individual responsibility falls on him/her in safety critical communication.

### **C. Speech Rules and Patterns**

**AIM:** To understand the importance of speech rules and patterns in safety critical communication.

### **LEARNING OUTCOMES**

1. Knows the national speech rules and patterns related to the profession.
2. Explains the importance of speech rules and patterns in safety critical communication.
3. Gives importance to work by following the rules and patterns of speech.

### **D. Effective Communication Skills**

**AIM:** To communicate using effective communication skills.

### **LEARNING OUTCOMES**

1. Explains the key elements of effective communication skills.
2. Lists the differences between hearing and listening.
3. Evaluates the importance of active listening in safety critical communication.
4. Repeats orders while carrying out the duty.
5. Cares about the key rules of effective communication during the duty.

### **E. Communication Barriers**

**AIM:** To understand basic communication errors and barriers.

### **LEARNING OUTCOMES**

1. Explains common mistakes and communication barriers in communication.
2. Realizes the basic communication mistakes made during communication.

### **F. Collaboration in Communication and Managing Work Stress**

**AIM:** To work in accordance with team communication and teamwork and to be able to manage work stress.

### **LEARNING OUTCOMES**

1. Explains the benefits of cooperation in communication brought to working life.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



2. Takes appropriate measures to manage work stress.
3. Minds cooperating with teammates during the execution of safety critical duties.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b> <b>COURSE CODE AND TITLE</b> <b>COURSE SEMESTER</b> <b>WEEKLY COURSE PERIOD</b> <b>COURSE DURATION</b>	<b>RAIL SYSTEM MANAGEMENT</b> <b>RAIL SYSTEM CONSTRUCTION</b> <b>RAIL SYSTEM ELECTRIC ELECTRONICS</b> <b>CRISIS MANAGEMENT</b>  2+2; 4,0
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### **AIMS**

1. To be able to explain the concept of crisis management
2. To know how the information flow occurs related to crisis management
3. Utilization of information related to crisis management

### **SPECIAL DEFINITIONS**

Course topics will be the presentation of the subject in need of explanation instead of every aspect of the place should be given. On-site observations and practices related to the course subjects can be given.

### **EVAULATION TABLE**

The percentages of the studies conducted related to topic and teaching style are given according to their weights in the table below. While final exam questions preparing, this percentage shall be taken into account.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Introduction to Crisis Management	25
B. Identifying a Crisis; Crisis Management Basics; Crisis Stages; Establishing a Crisis Management Team; The Role of the Crisis Manager	25
C. Putting Crisis Management Into Action; Crisis Management Decisions; Emergency Response Scenarios	25
D. Common Crisis Management Plan; Weaknesses Contingency Plans; Damage Control; Crisis Management Checklist	25





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### **TOPICS**

#### ***A. Introduction to Crisis Management***

**AIMS:** To be able to explain the concept of crisis management

#### **LEARNING OUTCOMES**

1. To explain the concept of crisis management
2. To know the principles of crisis management

#### ***B. Identifying a Crisis; Crisis Management Basics; Crisis Stages; Establishing a Crisis Management Team; The Role of the Crisis Manager***

**AIMS:** To be able to know the basics and stages of crisis management

#### **LEARNING OUTCOMES**

1. To know the basics of crisis management
2. To know its stages
3. To know how to establish a crisis management team and the role of the crisis manager

#### ***C. Putting Crisis Management Into Action; Crisis Management Decisions; Emergency Response Scenarios***

**AIMS:** To be able to know how to put crisis management into practice.

#### **LEARNING OUTCOMES**

1. To know the implementation level of crisis management
2. To know how to make crisis management decisions
3. To know how to deal with emergency response scenarios.

#### ***D. Common Crisis Management Plan; Weaknesses Contingency Plans; Damage Control; Crisis Management Checklist***

**AIMS:** To be able to know and use information related crisis management plans, damage control and checklists...

#### **LEARNING OUTCOMES**

1. To understand the common crisis management plans;
2. To know weaknesses plans;
3. To know damage controls;
4. To know crisis management checklists.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b> <b>COURSE CODE AND TITLE</b> <b>COURSE SEMESTER</b> <b>WEEKLY COURSE PERIOD</b> <b>COURSE DURATION</b>	<b>RAIL SYSTEM MANAGEMENT</b> <b>INTRODUCTION TO PROFESSIONAL LIFE</b>
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### **AIMS**

1. Get to know different professions in the field of operation and transport
2. Insight into various commercial and administrative professions in the railway sector
3. Know that the rail transport sector opens up a wide range of career opportunities in the fields of engineering, technology and IT
4. Get to know further professional employment opportunities in public personnel transport
5. Insight into ways of dealing with customers in a purposeful and professional manner
6. Get to know the basic elements of dealing professionally with customers and possible complaints

### **SPECIAL DEFINITION**

In this module, the student learns about different occupational areas with corresponding occupational possibilities in the field of 'rail transport'. A basic short introduction to the topics of business etiquette and complaint management provide employees who work with customers (e.g. at the information/sales counter, train attendants, etc.) important know-how on how to act in a more professional and customer-oriented way.

### **EVAULATION TABLE**

The percentages of the conducted studies according per subject are given in the table below. These percentages shall be taken into account during the preparation of final exam.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Professions in the railway operations and transport sector	15
B. Professions in the commercial sector and in administration	15
C. Job opportunities in the field of engineering, technology & IT	15
D. Professions in public transport	20
E. Business etiquette when working with customers in rail transportation	20
F. Customer orientation and complaint management	





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### TOPICS

#### **A. Professions in the railway operations and transport sector**

**AIM:** Get to know different professions in the field of operation and transport

#### **LEARNING OUTCOMES**

1. Insight into different occupational possibilities in the field of operation and traffic in railway transport.
2. Develop a basic understanding of what tasks railway operations managers, train service providers, locomotive shunting drivers, train drivers, traffic masters, etc. perform.
3. Knowledge about training, earning opportunities and career opportunities as a railway employee in the area of operations and traffic.

#### **B. Professions in the commercial sector and in administration**

**AIM:** Insight into various commercial and administrative professions in the railway sector

#### **LEARNING OUTCOMES**

1. Know which commercial and administrative job opportunities are available in the field of rail transport.
2. Development of a basic understanding of the tasks performed by commercial staff for rail and road transport/for freight forwarding and logistics/for transport services, controllers, stewards, train attendants, etc.
3. Knowledge of training, earning opportunities and career opportunities as a railway employee in the commercial area or administration.

#### **C. Job opportunities in the field of engineering, technology & IT**

**AIM:** Know that the rail transport sector opens up a wide range of career opportunities in the fields of engineering, technology and IT

#### **LEARNING OUTCOMES**

1. Development of a basic understanding of the importance and necessity of well-qualified employees in the field of engineering, technology and IT in railway transport.
2. Insight into basic fields of activity of industrial-technical specialists in the field of railway transport (e.g. mechatronics engineer, electrical engineer, operating technician in track construction, etc.).
3. Development of a basic understanding of diverse fields of work that are necessary for the holistic functioning of 'railway transport'.

#### **D. Professions in public transport**

**AIM:** Get to know further professional employment opportunities in public personnel transport

#### **LEARNING OUTCOMES**

1. Insight into various job opportunities in the field of public personnel transport.
2. Get to know basic tasks of customer service representatives, security workers, transport planners, train attendants, professional drivers, industrial mechanics, consultants etc. in rail transport.
3. Develop a basic understanding of diverse tasks and areas of activity in public personnel transport.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### ***E. Business etiquette when working with customers in rail transportation***

**AIM:** Insight into ways of dealing with customers in a purposeful and professional manner

#### ***LEARNING OUTCOMES***

1. Development of a basic understanding of the importance and necessity of professional interaction with customers (especially for train attendants, customer service staff, etc.).
2. Know that first impressions, communication style (sound of voice, use of language, etc.), body language and appropriate manners determine the interaction with customers.
3. Know basic elements of goal-oriented and professional business etiquette that are relevant when working with customers in rail transport.

### ***F. Customer orientation and complaint management***

**AIM:** Get to know the basic elements of dealing professionally with customers and possible complaints

#### ***LEARNING OUTCOMES***

1. Get to know basic elements to increase customer orientation.
2. Develop a basic understanding of how to deal with customer concerns, wishes and complaints.
3. Insight into target-oriented possibilities of satisfactory complaint management in rail transport.







## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b>	<b>RAIL SYSTEM MANAGEMENT RAIL SYSTEM CONSTRUCTION RAIL SYSTEM ELECTRIC ELECTRONICS PROJECT ON RAILWAY TECHNOLOGY</b>
<b>COURSE CODE AND TITLE</b>	
<b>COURSE SEMESTER</b>	
<b>WEEKLY COURSE PERIOD</b>	
<b>COURSE DURATION</b>	

### **AIMS**

1. To choose a general topic for a railway technology theme, develop it into a research framework with related aims and objectives that can be investigated within various time and resource limits.
2. To gain knowledge of carrying out a systematic search in the library, in scientific and other databases.
3. To interpret and evaluate data and literature critically.
4. To argue, structure the argumentation, and follow good scientific use of references.
5. To identify ethical issues in a research project and register the project for ethical clearance.
6. To define and frame an independent research project under supervision.

### **SPECIAL DEFINITION**

The course helps students to start writing their master thesis in time. Students acquire writing training and practical insights into the research process. The course aims at offering students more insight into the writing process behind a successful master thesis by working with a project proposal for the future master thesis. The project proposal forms the basis for the master thesis and the allocation of a supervisor.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Understanding the research framework	10
B. Good systematic literature review of the chosen topic	20
C. Interpretation and evaluation of data from the literature review	20
D. Discussion and argumentation of the outputs from the literature review	20
E. Identification of ethical issues of the chosen topics	10
F. Proposal of an independent research project	20





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### TOPICS

#### A. *Understanding the research framework*

**AIM:** To choose a general topic for a railway technology theme, develop it into a research framework with related aims and objectives that can be investigated within various time and resource limits.

#### LEARNING OUTCOMES

1. Draft paper (500 – 1000 words) with the aim to theme elaboration, perspective, and argument.
2. Compare the draft paper with other participants.

#### B. *Good systematic literature review of the chosen topic*

**AIM:** To gain knowledge of how to carry out a systematic search in the library, in scientific and other databases.

#### LEARNING OUTCOMES

1. The paper with literature review.
2. List of references from all databases which have been used.

#### C. *Interpretation and evaluation of data from the literature review*

**AIM:** To interpret and evaluate data and literature critically.

#### LEARNING OUTCOMES

1. Evaluation of the data from the literature review.
2. Comparison of the data from the literature review.

#### D. *Discussion and argumentation of the outputs from the literature review*

**AIM:** To argue, structure the argumentation, and follow good scientific use of references.

#### LEARNING OUTCOMES

1. Organized a discussion with the other participants.
2. Made a list of questions for discussion.
3. Evaluation of the discussion.

#### E. *Identification of ethical issues of the chosen topics*

**AIM:** To identify ethical issues in a research project and register the project for ethical clearance.

#### LEARNING OUTCOMES

1. Defines the ethical problems of research in general.
2. Identification of the ethical issues of the chosen topic.
3. Describes how could potential ethical conflicts be minimized.

#### F. *Proposal of an independent research project*

**AIM:** To define and frame an independent research project under supervision.

#### LEARNING OUTCOMES

1. Project draft (2 000 – 3 000 words), which seeks to develop the project towards a scientific problem, including essential references.
2. Uses references to the literature correctly.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b>	<b>RAIL SYSTEM MANAGEMENT</b>
<b>COURSE CODE AND TITLE</b>	<b>RAIL SYSTEM CONSTRUCTION</b>
<b>COURSE SEMESTER</b>	<b>RAIL SYSTEM ELECTRIC ELECTRONICS</b>
<b>WEEKLY COURSE PERIOD</b>	<b>SOCIAL ENVIRONMENTAL RESPONSIBILITIES</b>
<b>COURSE DURATION</b>	2+2; 4,0

### **AIMS**

1. Understand the knowledge, process and practice of sustainability management in an organisation
2. Be able to outline and articulate different approaches to social environmental responsibilities and their relative merits and suitability
3. Effectively argue in favour of an environmental improvement programme
4. Understand and apply the practical implications of waste management, cleaner technology and the circular economy
5. Understand and appreciate the analysis and range of complex issues involved in environmental management
6. Know a range of corporate sustainability management strategies and control mechanisms and be able to develop appropriate action to address a specific set of environmental issues
7. Know the literature and networks with which to support ongoing needs in environmental management.

### **SPECIAL DEFINITIONS**

Course topics will be the presentation of the subject in need of explanation instead of every aspect of the place should be given. On-site observations and practices related to the course subjects can be given.

### **EVAULATION TABLE**

The percentages of the studies conducted related to topic and teaching style are given according to their weights in the table below. While final exam questions preparing, this percentage shall be taken into account.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<i>TOPICS</i>	<i>Ratios of Topics (%)</i>
A. Introduction to Social Environmental Responsibilities	25
B. Corporate crime and malfeasance; Definitions and evaluation of key concepts, including corporate sustainability, corporate social responsibility (CSR), industrial ecology etc	25
C. Product-based sustainability; Reporting and stakeholder management	25
D. Risk management, risk perception and industrial accidents; Social enterprises, capital markets and corporate strategies.	25

### **TOPICS**

#### ***A. Introduction to Social Environmental Responsibilities***

**AIMS:** To be able to explain the concept of social environmental responsibilities

#### **LEARNING OUTCOMES**

1. To explain the concept of social environmental responsibilities
2. To know the principles of social environmental responsibilities

#### ***B. Corporate crime and malfeasance; Definitions and evaluation of key concepts, including corporate sustainability, corporate social responsibility (CSR), industrial ecology***

**AIMS:** To be able to know what corporate crime and other elements

#### **LEARNING OUTCOMES**

1. To know the corporate crime and malfeasance
2. To know its definition and evaluation of key concepts including corporate sustainability
3. To know corporate social responsibility
4. To know industrial ecology

#### ***C. Product-based sustainability; Reporting and stakeholder management***

**AIMS:** To be able to know what sustainability/reporting and stakeholder management are

#### **LEARNING OUTCOMES**

1. To know the product-based sustainability
2. To know what reporting and stakeholder management is.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



*D. Risk management, risk perception and industrial accidents; Social enterprises, capital markets and corporate strategies.*

**AIMS:** To be able to know risk management; social enterprises and its strategies.

**LEARNING OUTCOMES**

1. To understand the risk management;
2. To know risk perception and industrial accidents;
3. To know social enterprises
4. To know capital markets
5. To understand corporate strategies.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



PROGRAM TITLE	RAIL SYSTEM MANAGEMENT
COURSE CODE AND TITLE	RAIL SYSTEM CONSTRUCTION
COURSE SEMESTER	RAIL SYSTEM ELECTRIC ELECTRONICS
WEEKLY COURSE PERIOD	
COURSE DURATION	FOREIGN LANGUAGE

### AIMS

1. Gain knowledge and experience in both oral and written communication in work related situations.
2. Practise and improving job-specific conversation in a foreign language
3. Have appropriate reading, listening, writing and speaking competences
4. Practise and improving job-specific conversation in the foreign language

### SPECIAL DEFINITION

Foreign languages are an important competence that should be taught in railway transportation courses. Students should be able to speak, read, write in the foreign language for work related communication situations with customers and clients. They should know the respective vocabulary and grammar to inform them, reply to frequently asked questions and requests. In order to practice, the course should be supported by role-plays of work related situations and homework.

### EVAULATION TABLE

The percentages of the conducted studies according per subject are given in the table below. These percentages shall be taken into account during the preparation of final exam.

TOPICS	Ratios of Topics (%)
A. Listening and Speaking skills	30
B. Conversation Training	30
C. Reading skills	20
D. Writing skills	20

### TOPICS

#### G. Listening and Speaking skills

**AIM:** Have knowledge and competences of understanding texts in typical work related topics that the student listens to; and be able to respond in spoken language in a respective formal manner.

#### LEARNING OUTCOMES

1. To listen carefully and respond to the content and context of communication in appropriate manner
2. To listen and respond to spoken language, including straightforward information and narratives, and follow straightforward explanations and instructions





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



3. To speak to communicate information, feelings and opinions on typical work related topics, using appropriate formality
4. To engage in discussion with one or more people in a typical work related situation, making relevant points and responding to what others say to reach an understanding about typical work related topics.
5. To use clear and concise communication to proactively shape the development of a conversation

### ***H. Conversation Training***

**AIM:** Practising and improving job-specific conversation in a foreign language

#### **LEARNING OUTCOMES**

1. Practise goal-oriented communication in dealing with customers (e.g. information/consultation talks with customers, conversations between train attendants and customers, etc.).
2. Improve skills related to 'active listening', responding to customers' wishes, importance of appreciative and empathetic communication design
3. Practise solution-oriented communication in the case of complaints/claims from customers.

### ***I. Reading skills***

**AIM:** Foster the ability to read and understand typical work related texts and respond to respective contents.

#### **LEARNING OUTCOMES**

1. Read and understand short, straightforward texts on typical work related topics accurately and independently.
2. Read and obtain information from everyday sources that belong to the work context
3. Respond to the content and context of communication in appropriate manner

### ***J. Writing skills***

**AIM:** To be able to write information and opinions, ideas on work related topics.

#### **LEARNING OUTCOMES**

1. Write to communicate information and opinions with some adaptation to the intended audience.
2. Write to communicate information, ideas and opinions clearly using length, format and style appropriate to purpose and audience





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b>	<b>RAIL SYSTEM MANAGEMENT</b>
<b>COURSE CODE AND TITLE</b>	<b>RAIL SYSTEM CONSTRUCTION</b>
<b>COURSE SEMESTER</b>	<b>RAIL SYSTEM ELECTRIC ELECTRONICS</b>
<b>WEEKLY COURSE PERIOD</b>	
<b>COURSE DURATION</b>	<b>EFFECTIVE COMMUNICATION SKILLS</b>

### **AIMS**

1. Gaining knowledge and experience in both oral and written communication in work related situations.
2. Learn to express and interpret thoughts and feelings in both oral and written form.
3. Learn to listen to the needs, experiences, arguments and demands of others.
4. Learn to respect their views and respond to these in an adequate way.
5. Learn helpful communication strategies to improve communication skills.
6. Knowledge about elements of non-verbal communication as well as their importance in communication design.
7. Learn and practice simple ways to improve verbal communication skills.
8. Introduction to basic elements of written communication design.

### **SPECIAL DEFINITION**

The concept of effective communication and related aspects should be taught in rail transportation courses. Students should be able to communicate to customers, they shall inform, help, support them in an appropriate way in typical work related situations. They should learn about the components that an effective communication builds upon and they should experience it on-site. Information about basic knowledge regarding effective communication should be obtained. In order to practice, the course should be supported by role-plays with peers to experience oral communication situation and by written homework to explore replies to customer requests, offers to customers on railway travels and trips in particular.







## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### **EVAULATION TABLE**

The percentages of the conducted studies according per subject are given in the table below. These percentages shall be taken into account during the preparation of final exam.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Written and oral expression and understanding	15
B. Respect for and understanding of diverse points of view and needs, demands and arguments of other people involved in the communication	15
C. Constructive and goal-oriented communication design	20
D. Nonverbal communication - body language	15
E. Verbal communication skills	20
F. Writing Communication in the workplace	15

### **TOPICS**

#### **A. Written and oral expression and understanding**

**AIM:** Enrich the capacity of passing on knowledge and experience by communicating facts as well as expressing and interpreting thoughts and feelings in both oral and written form in work related communication situations.

#### **LEARNING OUTCOMES**

1. To know about communication channels of humans (visual, auditive and kinaesthetic/tactile).
2. To be able to reason and respond to requests when necessary and to be able to express agreement or disagreement in a constructive manner.
3. To use clear and concise communication to proactively shape the development of a conversation.
4. To know the 7 Cs in communication.

#### **B. Respect for and understanding diverse points of view and needs, demands and arguments of other people involved in the communication**

**AIM:** Foster the ability to listen to the needs, experiences, arguments and demands of others, to respect their views and respond to these in an adequate way.

#### **LEARNING OUTCOMES**

1. To know about “respect” as a basic value.
2. To be able to behave according to the code of conduct within certain settings.
3. To be able to listen carefully and to respond to the content and context of communication in an appropriate manner.
4. To be able to check attention and reception of information conveyed with the audience (people receiving the information).

#### **C. Constructive and goal-oriented communication design**





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



**AIM:** Learn helpful communication strategies to improve communication skills.

### **LEARNING OUTCOMES**

1. Sensitise one self towards counter-productive elements/ barriers in communication.
2. Practise goal-oriented ways of shaping communication in sensitive and difficult conversations (e.g. disagreements, misunderstandings, conflicts).
3. Get to know basic feedback rules and be able to apply constructive feedback.

### **D. Nonverbal communication - body language**

**AIM:** Knowledge about elements of non-verbal communication as well as their importance in communication design.

### **LEARNING OUTCOMES**

1. Know different types of nonverbal communication.
2. Develop a basic understanding of how nonverbal communication can and should be used in the workplace.
3. Be able to read, interpret and use body language.

### **E. Verbal communication skills**

**AIM:** Learn and practice simple ways to improve verbal communication skills.

### **LEARNING OUTCOMES**

1. Reflect upon/ be sensitised regarding one's own communication behavior.
2. Know that by listening attentively, reading body language, asking questions, etc., communication can be improved.
3. Be able to apply simple rhetorical and argumentation techniques.

### **F. Writing Communication in the workplace**

**AIM:** Introduction to basic elements of written communication design.

### **LEARNING OUTCOMES**

1. Know what to consider when writing emails, letters, reports, or presentations.
2. Become familiar with and practice effective writing strategies for written communication.

Develop goal-oriented





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b>	<b>RAIL SYSTEM MANAGEMENT</b>
<b>COURSE CODE AND TITLE</b>	<b>RAIL SYSTEM CONSTRUCTION</b>
<b>COURSE SEMESTER</b>	<b>RAIL SYSTEM ELECTRIC ELECTRONICS</b>
<b>WEEKLY COURSE PERIOD</b>	
<b>COURSE DURATION</b>	<b>BASIC COMPUTER SKILLS</b>

### **AIMS**

1. To introduce students to the basics of computer hardware and software. This includes topics such as the different components of a computer, how to use a computer, and how to install and use software.
2. To help students develop the skills needed to use computers for everyday tasks, such as word processing, spreadsheeting, and internet browsing. This includes topics such as how to create and edit documents, how to create and use spreadsheets, and how to search for information on the internet.
3. To encourage students to use computers to learn new things and to be more productive in their lives. Computers can be a powerful tool for learning and productivity. By learning basic computer skills, students can gain the ability to use computers to improve their lives.

### **SPECIAL DEFINITION**

Hands-on lab exercises: These exercises will give students a chance to practice the skills they have learned in the lecture. Online tutorials: These tutorials can provide students with additional information on the topics covered in the lecture. Discussion forums: These forums can provide students with a chance to ask questions and get help from their classmates and the instructor.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Introduction to computer, history of computer, operating systems, introduction to operating systems	30
B. Office software	40
C. Effective use of the Internet	30





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### TOPICS

#### A. *Introduction to computer, history of computer, operating systems, introduction to operating systems*

**AIM:** To know introduction to computer, history of computer, operating systems, introduction to operating systems

#### **LEARNING OUTCOMES**

1. To know and use introduction to computer, history of computer, operating systems, introduction to operating systems

#### B. *Office software*

**AIM:** Using office software effectively

#### **LEARNING OUTCOMES**

1. To use word processors, spreadsheets programs, presentation programs.

#### C. *Effective use of internet*

**AIM:** To use of internet effectively

#### **LEARNING OUTCOMES**

1. To use effective use of the internet, computer and network security, latest strategic technologies of informatics, factors affecting technological developments, internet and technology addiction and prevention.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b>	<b>RAIL SYSTEM MANAGEMENT</b>
<b>COURSE CODE AND TITLE</b>	<b>RAIL SYSTEM CONSTRUCTION</b>
<b>COURSE SEMESTER</b>	<b>RAIL SYSTEM ELECTRIC ELECTRONICS</b>
<b>WEEKLY COURSE PERIOD</b>	
<b>COURSE DURATION</b>	<b>RAILWAY SYSTEM MANAGEMENT</b>

### **AIMS**

1. To be able to explain the definition of transportation in general, the historical development passenger and baggage transportation and the issues related to international transportation irregularities, process of railways and basic concepts
2. To be able to explain and apply the issues related to the provisions of domestic goods transportation
3. To be able to define and apply the issues related to the provisions of international railway goods,

### **SPECIAL STATEMENTS**

In order to increase the student's technical equipment related to rail systems, it should be ensured that students understand the history of rail systems, general definitions, signs used to ensure traffic safety and the definition of traffic systems. Students are expected to reach maneuver communication, passenger and freight transport.

### **EVALUATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. Final exam questions preparing this percentage shall be taken into account.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Definition of Transportation, Historical Development Process and Basic Concepts of Railways	30
B. Issues Concerning the Provisions of Domestic Goods Transportation	30
C. Issues relating to the provisions of international railroad goods, passengers and baggage provisions and issues concerning international transport irregularities	40

### **TOPICS**

**A. Definition of Transportation, Historical Development Process and Basic Concepts of Railways**





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



**AIM:** To define the terms used in railways, to comprehend the concept of train and its features; classify trains, explain station concept, characteristics and types.

### **LEARNING OUTCOMES**

1. Defines the terms used in railways.
2. Defines the concept and characteristics of train; classify trains.
3. Defines station concept and properties; categorize stations.

### ***B. Issues Concerning the Provisions of Domestic Goods Transportation***

**AIM:** To be able to define pricing and freight payments with domestic goods transportation documents on railways, to comprehend the regulation of goods transportation documents, to explain pricing and freight payments.

### **LEARNING OUTCOMES**

1. Defines domestic goods transportation documents and pricing and freight payments.
2. It generally issues documents for carrying goods. Apply pricing and freight payments on the document.

### ***C. Issues relating to the provisions of international railroad goods, passengers and baggage provisions and issues concerning international transport irregularities***

**AIM:** To define the provisions of international railway goods transportation, to comprehend international railway passenger and baggage transportation provisions, to explain international transportation irregularities.

### **LEARNING OUTCOMES**

1. Defines and applies the issues related to the provisions of international rail transport of goods (CIM).
2. Identifies and applies the issues related to international railway passenger and baggage transport provisions (CIV).
3. Defines and applies the issues related to international transportation.





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<b>COURSE SEMESTER</b>	<b>RAIL SYSTEM ELECTRIC ELECTRONICS</b>
<b>WEEKLY COURSE PERIOD</b>	<b>TRANSPORTATION MANAGEMENT</b>
<b>COURSE DURATION</b>	<b>2+2; 4,0</b>

### **AIMS**

1. To be able to understand the key transportation concepts and objective;
2. To understand freight movements, intermodal transportation, modal characteristics, transportation policy, pricing and costing;
3. To know the changes occurring in the industry such as the emergence of third-party transportation providers, security, globalization, use of technology, and supply chain management.

### **SPECIAL DEFINITIONS**

Course topics will be the presentation of the subject in need of explanation instead of every aspect of the place should be given. On-site observations and practices related to the course subjects can be given.

### **EVAULATION TABLE**

The percentages of the studies conducted related to topic and teaching style are given according to their weights in the table below. While final exam questions preparing, this percentage shall be taken into account.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<i>TOPICS</i>	<i>Ratios of Topics (%)</i>
A. Introduction to Transportation Management	25
B. Significance of transportation and effect on economic development and global trade;	25
C. Transportation economics; Transportation regulation and deregulation; Transportation public policy and promotion; Transportation and logistics	25
D. Modal characteristics and operations; Principles of transportation & logistics; Transportation costing and pricing; Transportation risk management and security; International transportation; Third-party transportation providers; Private transportation; Future transportation challenges	25

### ***TOPICS***

#### ***A. Introduction to Transportation Management***

***AIMS:*** To be able to explain the concept of transportation management

#### ***LEARNING OUTCOMES***

1. To explain the concept of transportation management
2. To know the principles of transportation management

#### ***B. Significance of transportation and effect on economic development and global trade***

***AIMS:*** To be able to know what transportation management is

#### ***LEARNING OUTCOMES***

1. To know the significance of transportation
2. To know its effect on economic development and global trade

#### ***C. Transportation economics; Transportation regulation and deregulation; Transportation public policy and promotion; Transportation and logistics***

***AIMS:*** To be able to know what transportation economics are.

#### ***LEARNING OUTCOMES***

1. To know what transportation economics including its regulation and deregulation;
2. To know the transportation public policy and promotion;
3. To know transportation and logistics







## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



*D. Modal characteristics and operations; Principles of transportation & logistics; Transportation costing and pricing; Transportation risk management and security; International transportation; Third-party transportation providers; Private transportation; Future transportation challenges*

**AIMS:** To be able to know and use information related transportation management, its characteristics.

### **LEARNING OUTCOMES**

1. To understand the transportation management and its characteristics/operations;
2. To know principles of transportation and logistics
3. To know its costing and pricing;
4. To know the risk management and security related to transportation management;
5. To understand the principles of international transportation;
6. To understand the third-party transportation providers and private transportation;
7. To know the future of transportation and its challenges.





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<b>COURSE CODE AND TITLE</b>	<b>RAIL SYSTEM CONSTRUCTION</b>
<b>COURSE SEMESTER</b>	<b>RAIL SYSTEM ELECTRIC ELECTRONICS</b>
<b>WEEKLY COURSE PERIOD</b>	<b>LOGISTIC MANAGEMENT</b>
<b>COURSE DURATION</b>	<b>2+2; 4,0</b>

### **AIMS**

1. To be able to explain the concept of logistic management
2. To know how the information flow occurs related to logistic management
3. Utilization of information related to logistic management

### **SPECIAL DEFINITIONS**

Course topics will be the presentation of the subject in need of explanation instead of every aspect of the place should be given. On-site observations and practices related to the course subjects can be given.

### **EVAULATION TABLE**

The percentages of the studies conducted related to topic and teaching style are given according to their weights in the table below. While final exam questions preparing, this percentage shall be taken into account.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Introduction to logistic management	25
B. Logistic Management and its elements; Modern Concepts in Logistics	25
C. Role of logistics in strategy; Inbound and outbound supply chain management	25
D. Container – types; Different types of cargo; Packaging and Material Handling	25

### **TOPICS**

#### **A. Introduction to logistic management**

**AIMS:** To be able to explain the concept of logistic management

#### **LEARNING OUTCOMES**

1. To explain the concept of logistic management





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



2. To know the principles of logistic management and its history

### ***B. Logistic Management and its elements; Modern Concepts in Logistics***

**AIMS:** To be able to know what logistic management is and its elements and concepts.

#### **LEARNING OUTCOMES**

1. To know the elements of logistic management
2. To know its concepts in logistics

### ***C. Role of logistics in strategy; Inbound and outbound supply chain management***

**AIMS:** To be able to know what role of logistics and inbound/outbound supply chain management

#### **LEARNING OUTCOMES**

1. To know the role of strategic logistics
2. To know the inbound and outbound supply chain management

### ***E. Container – types; Different types of cargo; Packaging and Material Handling***

**AIMS:** To be able to know and use information related container types; cargo types, packaging and material handling

#### **LEARNING OUTCOMES**

1. To understand Container types;
2. To know different types of cargo;
3. To know packaging
4. To know material handling





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b>	<b>RAIL SYSTEM MANAGEMENT</b>
<b>COURSE CODE AND TITLE</b>	<b>CONSTRUCTION</b>
<b>COURSE SEMESTER</b>	
<b>WEEKLY COURSE PERIOD</b>	<b>NEW TECHNOLOGIES IN RAIL SYSTEMS</b>
<b>COURSE DURATION</b>	

### **AIMS**

1. To introduce students to the latest technologies being used in rail systems.
2. To help students understand the benefits of these new technologies. This includes topics such as improved safety, increased efficiency, and reduced environmental impact.
3. To encourage students to consider careers in the rail industry. The rail industry is a growing sector with a wide range of career opportunities. By learning about new technologies in rail systems, students can gain the skills and knowledge needed to pursue a rewarding career in this field.

### **SPECIAL DEFINITION**

The history of new technologies in rail systems: This includes the history of new technologies in rail systems in different parts of the world, as well as the factors that have contributed to the development of new technologies in rail systems. The different types of new technologies in rail systems: This includes the different types of new technologies in rail systems, such as driverless trains, and smart ticketing. The challenges and opportunities facing new technologies in rail systems: This includes topics such as funding, planning, construction, operation, and maintenance of new technologies in rail systems.

### **EVAULATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Train control system with radio communication	30
B. The standardization of railway systems for fostering interoperability	40
C. Staff and customer friendly train designs	30

### **TOPICS**

**D. Understands the train control system with radio communication**

**AIM:** To know the train control system with radio communication

### **LEARNING OUTCOMES**

1. To understand the train control system with radio communication.

**E. The standardization of railway systems for fostering interoperability**





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



**AIM:** To know standardization of railway systems for fostering interoperability in international railway corridors.

**LEARNING OUTCOMES**

1. Understands standardization of railway systems for fostering interoperability

**F. Staff and customer friendly train designs**

**AIM:** To understand and customer friendly train designs

**LEARNING OUTCOMES**

1. To know and understand and customer friendly train designs, modular approach based on plug and play, energy consumption by rail sub-systems and components.





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



<b>PROGRAM TITLE</b> <b>COURSE CODE AND TITLE</b> <b>COURSE SEMESTER</b> <b>WEEKLY COURSE PERIOD</b> <b>COURSE DURATION</b>	<b>RAIL SYSTEM CONSTRUCTION</b> <b>SURVEYING</b>
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### **AIMS**

1. To understand the fundamental of the surveying and mapping process.
2. To get an overview of geographic information systems.
3. To get aquatinted with conventional surveying accessories.
4. To understand the principles of global navigation satellite systems.
5. To familiarize with methods of coordinate geometry calculations.
6. To understand the principles of photogrammetry and laser scanning.

### **SPECIAL DEFINITION**

The objective of the course is to provide basics of digital surveying and mapping of Earth's surface using total station, GPS, and mapping software. Students are acquainted with methods of measurements and calculations with a focus on railway construction, works with a theodolite, total station, levelling instrument, measuring angles, lengths, elevations, setting out, and computation coordinates. Students can handle simple construction projects of polar coordinates, technical levelling, and altimetry measurements. Students learn the fundamental measuring techniques and the associated mathematical and analytical principles to determine geospatial locations

### **EVALUATION TABLE**

The percentages of the studies conducted according to the subject and teaching style according to the subject areas are given in the table below. These percentages shall be taken into account during the preparation of final exam questions.

<b>TOPICS</b>	<b>Ratios of Topics (%)</b>
A. Introduction to surveying and mapping	20
B. Geographic information systems (GIS)	15
C. Surveying equipment and accessories	20
D. Global navigation satellite systems (GNSS)	15
E. Computation and adjustments	20
F. Photogrammetry and laser scanning	10





## DEVELOPMENT OF EDUCATION MODULES FOR RAIL SYSTEM CONSTRUCTION



### TOPICS

#### A. *Introduction to Surveying and Mapping*

**AIM:** To understand the fundamental of the surveying and mapping process.

##### **LEARNING OUTCOMES**

1. Explores the science of geodesy, and the size and shape of the Earth.
2. Understands principles and theories used to establish control surveys and survey networks based on geodesy.
3. Gets acquainted with fundamental measuring techniques.

#### B. *Geographic information systems (GIS)*

**AIM:** To get an overview of geographic information systems.

##### **LEARNING OUTCOMES**

1. Manages sketching, line drawing, and solid modelling, the development and interpretation of site plans, utilities.
2. Operates CAD and GIS interfaces.
3. Understands the basics of cartography.

#### C. *Surveying equipment and accessories*

**AIM:** To get aquatinted with conventional surveying equipment accessories.

##### **LEARNING OUTCOMES**

1. Knows digital surveying and mapping procedure.
2. Works with theodolites and total stations.
3. Performs leveling survey and angular measurements.

#### D. *Global Navigation Satelite Systems (GNSS)*

**AIM:** To understand the principles of global navigation satellite systems.

##### **LEARNING OUTCOMES**

1. Understands principles and theories regarding GNSS systems.
2. Uses GNSS equipment for land surveying.

#### E. *Computation and adjustments*

**AIM:** To familiarize with methods of coordinate geometry calculations.

##### **LEARNING OUTCOMES**

1. Performs fundamental trigonometry calculations.
2. Computes a position on the earth using three-dimensional coordinate systems.
3. Processes coordinate transformation.

#### F. *Photogrammetry and laser scanning*

**AIM:** To understand the principles of photogrammetry and laser scanning.

##### **LEARNING OUTCOMES**

1. Understands the principles of remote sensing.
2. Works with laser scanners.
3. Processes point cloud data.

