University of Isfahan

Course Outline
Railway Track and Structural Engineering
Undergraduate Program

Department of Railway Engineering and Transportation Planning
Faculty of Civil Engineering and Transportation
University of Isfahan

Isfahan, Iran
www.ui.ac.ir

October 2024

1. Definition and goal

Railway Track and Structural engineering undergraduate program is one of the higher education programs that its goal is training skilled experts for design, construction and management of railway engineering projects.

2. Duration of Program and the structure

The average duration of this program is 4 years. Every semester lasts 16 complete weeks of education. Each theoretical course takes 16 hours, each laboratory course might take 32 or 48 hours, and each workshop takes 48 hours each semester.

3. Credits

The total number of credits in this program is 140 that is described in Table 1. The titles of the aforementioned courses are as listed in Table 1 to 4.

Table 1. Course credits of Railway Track and Structural Engineering Undergraduate Program

No.	Type of courses	Credits
1	General courses	22
2	Basic courses	21
3	Core courses	90
4	Optional courses	7
Total		140

Table 2. General courses for Railway Track and Structural Engineering undergraduate program

Course No.	Course Title	Credits	Hours per week			Prerequisites/ Co-requisites
			Theoretical	Practical	Guided learning	
1	Islamic Thought 1	2	2	-	-	**-**
2	Islamic Thought 2	2	2	-	-	**1**
3	Islamic Ethics	2	2	-	-	**-**
4	Islamic Revolution	2	2	-	-	**-**
5	Islamic History	2	2	-	-	**-**
6	Quran Studies	2	2	-	-	**-**
7	Human Right in Islam	2	2	-	-	**-**
8	General Literature	3	3	-	-	**-**
9	General Foreign Language	3	3	-		**-**
10	Physical Education 1	1	-	1	-	**-**
11	Physical Education 2	1	-	1	-	**10**
Total		22	20	2		

Table 3. Basic courses for Railway Track and Structural Engineering undergraduate program

Course No.	Course Title	Credits	Hours per week			Prerequisites/ Co-requisites
			Theoretical	Practical	Guided learning	
12	General Mathematics I	3	3	-	-	**-**
13	General Mathematics II	3	3	-	-	**12**
14	Differential Equations	3	3	-	-	**13 (P/C)**
15	Computer Programming	3	3	-	-	**-**
16	Numerical Analyses	2	2	-	-	**14, 15 (P/C)**
17	Statistics and Probability for Engineers	3	3		-	**14**
18	Physics I: Mechanics and Heat	3	3	-	-	**12 (P/C)**
19	Physics I Laboratory	1	-	1	-	**18 (P/C)**
Total		21	20	1	-	

Table 4. Core courses for Railway Track and Structural Engineering undergraduate program

Course No.	Course Title	Credits	Hours per week			Prerequisites/ Co-requisites
			Theoretical	Practical	Guided learning	
20	Engineering Drawing	2	1	1	-	**-**
21	Surveying Theory & Practice	2	1	1	-	**12**
22	Construction Materials & Concrete Technology	3	3	-	-	**26 (P/C)**
23	Construction Materials & Concrete Lab	1	-	1	-	**22 (P/C)**
24	General Workshop	1	-	1	-	**-**
25	Statics	3	3	-	-	**12**
26	Strength of Materials	3	-	-	-	**25**
27	Structural Analysis	3	3	-	-	**26**
28	Materials science and knowledge of metals in the railway	2	2	-	-	**26**
29	Design of reinforced concrete structures	3	3	-	-	**22,27**
30	Design of steel structures	3	3	-	-	**27**
31	Soil Mechanics	3	3	-	-	**26**
32	Soil Mechanics Lab	1	-	1	-	**31**
33	Geology & Rock Mechanics	2	2	-	-	**31 (P/C)**
34	Engineering Hydrology	2	2	-	-	**17**
35	Project Evaluation & Cost Estimation	1	-	1	-	**Semester 6 or later**
36	Dynamics	3	3	-	-	**25**
37	Fluid Mechanics	3	3	-	-	**36**

Source: Department of Civil Engineering and Transportation, University of Isfahan. Updated: 10/17/2024

38	Railway operations, time-tabling and control	2	2	-	-	**-**
39	Basics of electrical engineering in railways	3	3	-	-	**18**
40	Rail route planning and design	2	2	-	-	**21**
41	Rail route planning and design project	1	-	1	-	**40 (P/C)**
42	Railway Foundation Engineering	3	2	1	-	**29,31**
43	Railway Substructure Design	3	2	1	-	**31**
44	Railway Superstructure Design	3	3	-	-	**27**
45	Railway Superstructure Lab	1	-	1	-	**44 (P/C)**
46	Railway Yards Design and management	3	2	1	-	**43,44**
47	Railways Construction	3	2	1	-	**43,44**
48	Railways Track Maintenance	3	2	1	-	**46**
49	Rolling Stock Engineering	3	3	-	-	**46**
50	Bridge Design I	2	2	-	-	**29,30,34**
51	Bridge Design II	2	2	-	-	**50,53 (P/C)**
52	Tunnel and underground space engineering	2	2	-	-	**26,33,43**
53	Earthquake Engineering	2	2	-	-	**27,36**
54	Loading of structures	2	2	-	-	**53 (P/C)**
55	Surveying of Railway Path and Operation	2	1	1	-	**21,40 (P/C)**
56	Railway comunication and signalling Systems	3	3	-	-	**39**
57	Strategic management and economics in Railway transportatioon	2	2	-	-	**38**
58	Specialized railway project *	2	-	-	-	**After completing 100 credits**
59	Internship 1 **	-	-	-	-	**At least 70 credits must be taken**

60	Internship 2 **	-	-	-	-	**At least 100 credits must be taken**
Total		90	76	14		

* Note: As part of Railway Track and Structural Engineering's curriculum, all final year students are required to undertake a final project, supervised by one or two academic staff members of the Railway Engineering and Transportation Planning department.

** Note: As part of Railway Track and Structural Engineering's curriculum, all students are required to undertake two internships after passing at least 70 and 100 credits. The purpose of taking the internships is to get practical skills and work experience in the railway industry.

In Table 5, the optional courses of The Railway Track and Structural Engineering at the University of Isfahan are presented. Students should take 7 credits from the list of optional courses.

With the approval of the group, students can take a maximum of one course from the Master's degree courses in the field of railway track engineering and a maximum of one course from other fields as well.

Table 5. Optional courses for Railway Track and Structural Engineering undergraduate program

Course No.	Course Title	Credits	Hours per week			Prerequisites/ Co-requisites
			Theoretical	Practical	Guided learning	
1	Electrical and Mechanical facilities in railway	2	2	-	-	**46**
2	Systems engineering	2	2	-	-	**57**
3	Railway noise and vibration	3	3	-	-	**Semester 6 or later**
4	High Speed Railway Design	2	2	-	-	**44,49**
5	Technical language in railway engineering	2	2	-	-	**-**
6	Fundamentals of Metro Engineering	2	1	1	-	**Semester 6 or later**
7	Introduction of Practical Software in Railway Engineering	2	2	-	-	**Semester 6 or later**
8	Design of railway trnout and crossings	2	2	-	-	**46**
9	Urban transportation planning	2	2	-	-	**-**
10	Project management in railway construction	2	2	-	-	**47**
11	Railway Electrification	2	2	-	-	**39**
12	Rail welding and weld inspection	2	1	1	-	**28**

13	Quality Control in Railway Engineering	2	2	-	-	**47**
14	Railway bridges project	1	-	1	-	**51 (P/C)**
15	Principles and techniques of negotiation	1	1	-	-	**-**
16	Business Management and its application in railway	2	2	-	-	**Semester 6 or later**
17	Casting workshop	1	-	1	-	**49**
18	locomotive workshop	1	-	1	-	**49**
19	Wagon and brake workshop	1	-	1	-	**49**
20	Welding & Sheetmetal Workshop	1	-	1	-	**-**
21	Machine tools workshop	1	-	1	-	**-**
22	Digitalization in railway	2	2	-	-	**-**
23	Design of Railway Bogie, Wheel and Axle	2	2	-	-	**49**
Total		40	32	8		

MATHEMATICS I

BASIC INFORMATION

Place in Curriculum, title and semester: Basic, Mathematics I, S1

Number of credits: 3

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Mathematical Sciences
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	1 h	-	1 h

COURSE OBJECTIVES

Introduction to mathematics including limits, derivatives, integrals, series, … Students are expected to:

- ✓ Learn the principals of mathematics for engineering courses
- ✓ Learn Integration Techniques
- ✓ Learn how to deal with functions and derivatives

REQUIRED STUDENT RESOURCES

Textbooks:

1. L. Leithold, “The Calculus with Analytic Geometry”, Vol. I, II, 5th Edition, Harper and Row Publisher, 1986.
2. R. A. Silverman, “Calculus with Analytic Geometry”, 4th Edition, Prentice Hall, 1984.
3. G. B. Thomas, “Elements of Calculus and Analytic Geometry”, Addison Wesley, 1981.
4. R. Larson, “Calculus with Analytic Geometry”, 7th Edition, 2002.

References:

1. G. B. Thomas, “Elements of Calculus and Analytic Geometry”, Addison Wesley, 1981.

Web links:

Computer Software:

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	Real numbers, Maximum, Minimum, infimum, Supremum
2	Series and the related Theorem
3	Series and the related Theorem
4	Functions and algebra of functions, limits
5	Function Continuity and theorems
6	Derivatives and its applications
7	Theorems of derivations
8	Logarithmic functions, inverse of a function, hyperbolic functions,
9	Trigonometric functions
10	Integrals and fundamentals of differentials,
11	Definite and indefinite integrals,
12	Integration Techniques, variable changes in integration
13	Integral applications, length of a curve, area, and volume
14	Series, power series,
15	Taylor's formula
16	Numerical methods

EVALUATION PROCEDURES AND GRADING CRITERIA

Indicate how students are evaluated, including tests, quizzes, papers, assignments, the weight of the assignments, etc. Identify how the course grades are determined, clearly.

Assignments	20 points
Mid-Term Exam	40 points
Final Exam	40 points
Total Points	100 points

ATTENDANCE STATEMENT

The course instructor must clearly inform students on the first day of class and in writing in the syllabus of their (1) policy regarding class absence and (2) policy, if any, for making up missed assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

STUDENTS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS STATEMENT

The following statement must appear on all syllabi: “Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor and contact the Disability Services Office as soon as possible.”

APPROVED ACADEMIC HONESTY STATEMENT

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SYLLABI ON WEB PAGES

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MATHEMATICS II

BASIC INFORMATION

Place in Curriculum, title and semester: Basic, Mathematics II, S2

Number of credits: 3

COURSE PREREQUISITES:

Mathematics I

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Mathematical Sciences
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	1 h	-	1 h

COURSE OBJECTIVES

This course provides complementary topics in continue of the course mathematics I. Students are expected to:

- ✓ Learn about the linear, planar and spatial equations
- ✓ Multi variable functions and its derivations
- ✓ Integral applications in engineering

REQUIRED STUDENT RESOURCES

Textbooks:

1. L. Leithold, “The Calculus with Analytic Geometry”, Vol. I, II, 5th Edition, Harper and Row Publisher, 1986.
2. R. A. Silverman, “Calculus with Analytic Geometry”, 4th Edition, Prentice Hall, 1984.
3. R. Larson, “Calculus with Analytic Geometry”, 7th Edition, 2002.

References:

1. R. A. Silverman, “Calculus with Analytic Geometry”, 4th Edition, Prentice Hall, 1984.

Web links: -

Computer Software:

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	Linear algebra, vector, Matrices, and linear equations
2	Gauss–Jordan Method, Reduced Row Echelon Form
3	vector spaces, Spaces and Subspaces, independency
4	Matrix Algebra
5	Analytic Geometry, equations of lines, plane, curve
6	Cartesian, polar and cylindrical coordinates
7	Multi variables functions, Gradient, Jacobian,
8	Directional derivatives
9	Space curves, Surfaces
10	Quadrics
11	Multiple integrations, Moment of inertias
12	Pappus’ Theorem
13	Improper integrals
14	Change of variables in multiple integrals
15	Laplace, Curl, Divergence and Green theorem,
16	Integral Applications

EVALUATION PROCEDURES AND GRADING CRITERIA

Indicate how students are evaluated, including tests, quizzes, papers, assignments, the weight of the assignments, etc. Identify how the course grades are determined, clearly.

Assignments	20 points
Mid-Term Exam	40 points
Final Exam	40 points
Total Points	100 points

ATTENDANCE STATEMENT

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DIFFERENTIAL EQUATIONS

BASIC INFORMATION

Place in Curriculum, title and semester: Basic, Differential Equations, S2

Number of credits: 3

COURSE PREREQUISITES:

Mathematics I

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Mathematical Sciences
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	1 h	-	1 h

COURSE OBJECTIVES

Students are expected to:

- ✓ Learn how to solve various types of linear differential equations.
- ✓ Get familiar with applications of differential equations in physics and mechanics.

REQUIRED STUDENT RESOURCES

Textbooks:

1. W. E. Boyce, R. C. DiPrima, Elementary Differential Equations, 10th Edition, Wiley, 2012.

References:

1. C. H. Edwards, D. E. Penney, Elementary Differential Equations with Boundary Value Problems, 6th Edition, Prentice Hall, 2007.

2. W. E. Kohler, L. W. Johnson, Elementary Differential Equations with Boundary Value Problems, 2nd Edition, Addison Wesley, 2005.

Web links: -

Computer Software:

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	Introduction to differential equations
2	Nature of differential equations and their solution
3	The family of curves and orthogonal paths
4	Physical patterns
5	Separable equations
6	Linear differential equation
7	First order linear differential equations
8	Homogeneous equations
9	Second order linear differential equations
10	Method of undetermined coefficients
11	Method of variation of parameters
12	Applications of second-order equations in physics and mechanics
13	Solving differential equations using series
14	Bessel and Gamma functions, Legendre polynomials
15	Introduction to systems of differential equations
16	Laplace transform and its applications in differential equations

EVALUATION PROCEDURES AND GRADING CRITERIA

Indicate how students are evaluated, including tests, quizzes, papers, assignments, the weight of the assignments, etc. Identify how the course grades are determined, clearly.

Assignment “A”	10 points
Assignment “B”	10 points
Assignment “C”	10 points
Assignment “D”	10 points
Mid-Term Exam	140 points
Final Exam	220 points
Total Points	400 points

ATTENDANCE STATEMENT

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COMPUTER PROGRAMMING

BASIC INFORMATION

Place in Curriculum, title and semester: Basic, Computer Programming, S1

Number of credits: 3

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Computer Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	1 h

COURSE OBJECTIVES

Students are expected to:

- ✓ Understand the role of computations in Problem-Solving.
- ✓ Learn about the application of computer programming in mechanical and mechatronic systems.
- ✓ Design a computer program using a graphical user interface
- ✓ Develop a mobile application which can be used as a controller of a mechatronic system.

REQUIRED STUDENT RESOURCES

Textbooks:

1- M. Vine,''C Programming for the Absolute Beginner'', Course Technology PTR, 2002.
2- S. Kochan, ''Programming in C'', 3rd Edition, Sams, 2004.
3- P. Deitel, “Java How to Program”, 11th Edition, Sams, 2016.

References:

1- J. Stephen, “MATLAB Programming for Engineers”, 4rd Edition, Sams, 2009.

Web links:

Computer Software: Matlab, Eclipse, C++Builder, Visual Studio.net

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	Introduction to Computers and Programming Languages
2	Algorithm and Flowcharts; Data structures
3	Structural Programming and functions
4	Main Structures of Programming: Loops and Conditions
5	Introduction to Object Oriented Programming
6	Arrays and Matrices
7	Midterm
8	Graphical User Interface
9	Introduction to GUI design for a mobile application
10	Basic Concepts of Android Programming
11	Advanced Algorithms: Sort and Search
12	Recursive Functions
13	Programming with Integrated development environments: eclipse
14	Matlab Programming
15	Introduction to Matlab toolboxes
16	Advanced features of Matlab

EVALUATION PROCEDURES AND GRADING CRITERIA

Indicate how students are evaluated, including tests, quizzes, papers, assignments, the weight of the assignments, etc. Identify how the course grades are determined, clearly.

Assignments	40 points
Comprehensive Assignment	40 points
Mid-Term Exam	80 points
Project	100 points
Final Exam	140 points
Total Points	400 points

ATTENDANCE STATEMENT

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assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

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NUMERICAL ANALYSES

BASIC INFORMATION
Place in Curriculum, title and semester: Basic, Numerical Analyses, S4

Number of credits: 2

COURSE PREREQUISITES:
Differential Equations

COURSE CO-REQUISITES:
Computer Programming

TEACHERS:

Person in charge: Department of Mathematical Sciences
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
2 h	-	-	1 h

COURSE OBJECTIVES

Students are expected to:

- ✓ Be able to apply the numerical methods for differentiation, nonlinear equations, and simultaneous linear equations
- ✓ Understand different concepts of Fourier expansions, the speed of convergence and numerical analysis;
- ✓ Design a numerical computing algorithm and implement it using programming languages
- ✓ Be able to calculate errors and implement their relationship to the accuracy of the numerical solutions

REQUIRED STUDENT RESOURCES

Textbooks:
1- D. V. Griffiths, and I. M. Smith, "Numerical Methods for Engineers", Oxford, England,

UK: Blackwell Scientific Publications, 1991. (This book contains many FORTRAN examples.)
2- J. H. Ferziger, ''Numerical Methods for Engineering Application'', John Wiley, 1998.

References:

1- C. Gerald, P. Wheatley, ''Applied Numerical Analysis'', Addison Wesley Longman, 1999.
2- R. H. Pennington, ''Computer Methods and Numerical Analysis'', Macmillan, 2000.

Web links:

Computer Software: Matlab

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	Introduction to numerical analysis
2	Series expansions: from calculus to computation
3	Integrals as sums and derivatives as differences
4	Interpolation,
5	splines, and a second look at numerical calculus
6	Numerical methods for ODE, initial-value problems
7	Midterm
8	Root finding, Newton's method, boundary-value problems
9	Fourier transform, Fourier series
10	Bandlimited interpolation, spectral methods
11	Least-squares approximation
12	Function approximation using curve fitting and neural networks
13	Numerical Integration band differentiation
14	Advanced methods for Numerical differentiation
15	Linear equation systems
16	Advanced methods for the solution of Linear equation systems

EVALUATION PROCEDURES AND GRADING CRITERIA

Indicate how students are evaluated, including tests, quizzes, papers, assignments, the weight of the assignments, etc. Identify how the course grades are determined, clearly.

Assignments	40 points
Comprehensive Assignment	40 points
Mid-Term Exam	80 points
Project	40 points
Final Exam	100 points
Total Points	300 points

ATTENDANCE STATEMENT

The course instructor must clearly inform students on the first day of class and in writing in the syllabus of their (1) policy regarding class absence and (2) policy, if any, for making up missed assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

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SYLLABI ON WEB PAGES

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PHYSICS I: MECHANICS AND HEAT

BASIC INFORMATION

Place in Curriculum, title and semester: Basic, Physics I: Mechanics and Heat, S1

Number of credits: 3

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

Mathematics I

TEACHERS:

Person in charge: Faculty of Physics
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	1 h	-	1 h

COURSE OBJECTIVES

Students are expected to:

- ✓ provide students with a thorough understanding of the basic concepts of physics and the methods scientists use to explore natural phenomena
- ✓ Instruct students of the fundamental laws of physics and the application of scientific data, concepts, and models for use in the natural sciences and real-world situations.
- ✓ Provide students with Problem-Solving skills through an approach that describes physical phenomena with relevant mathematical models and formulae.
- ✓ Develop the student's mathematical ability to manipulate formulae and derive correct numerical solutions that can be measured in the real world.

REQUIRED STUDENT RESOURCES

Textbooks:

1- Halliday D., Resnick R., Walker J., Fundamentals of physics. 9th Edition, John Wiley & Sons: 2011. 1330 p.

References:

1- Cutnell J.D., Johnson K.W., Young D., Stadler S., Physics. 10th Edition, John Wiley & Sons: 2014. 992 p.
2- Bueche F.J., Hecht E., Schaum's Outline of College Physics, 11th Edition, McGraw-Hill, 2011.

Web links: -

Computer Software:

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	Measurement and scale
2	Motion, Position and Displacement, Average Velocity and Average Speed, Acceleration
3	Air processes using hot and cold air systems
4	Vectors and Scalars, Components of Vectors, Vectors and the Laws of Physics
5	Position and Displacement, Average Velocity and Instantaneous Velocity, Average Acceleration and Instantaneous Acceleration
6	Projectile Motion, Projectile Motion Analyzed, Relative Motion in One Dimension and Two Dimensions
7	Newton's First Law, Newton's Second Law, Newton's Third Law
8	Friction, The Drag Force and Terminal Speed, Uniform Circular Motion
9	Kinetic Energy, Work and Kinetic Energy, Work Done by a Spring Force, Work Done by a General Variable Force
10	Work and Potential Energy, Path Independence of Conservative Forces, Conservation of Mechanical Energy
11	Linear Momentum, The Linear Momentum of a System of Particles, Collision and Impulse, Elastic Collisions in One Dimension
12	Newton's Law of Gravitation, Gravitation and the Principle of Superposition
13	Density and Pressure of Fluids, Measuring Pressure, Pascal's Principle, Ideal Fluids in Motion
14	Temperature, The Zeroth Law of Thermodynamics, The Celsius and Fahrenheit Scales, Thermal Expansion
15	The First Law of Thermodynamics, Heat Transfer Mechanisms
16	Ideal Gases, Pressure, Temperature, and RMS Speed, The Molar Specific Heats of an Ideal Gas

EVALUATION PROCEDURES AND GRADING CRITERIA

Indicate how students are evaluated, including tests, quizzes, papers, assignments, the weight of the assignments, etc. Identify how the course grades are determined, clearly.

Assignment "A"	10 points
Assignment "B"	10 points
Assignment "C"	10 points
Assignment "D"	10 points
Mid-Term Exam I	60 points

Mid-Term Exam II	60 points
Final Exam	140 points
Total Points	300 points

ATTENDANCE STATEMENT

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STUDENTS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS STATEMENT

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APPROVED ACADEMIC HONESTY STATEMENT

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SYLLABI ON WEB PAGES

Syllabi presented on web pages shall contain the date of last update.

PHYSICS LABORATORY I

BASIC INFORMATION

Place in Curriculum, title and semester: Basic, Physics laboratory I, S2

Number of credits: 1

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

Physics I

TEACHERS:

Person in charge: Faculty of Physics
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
-	-	1 h	-

COURSE OBJECTIVES

Students are expected to:

- ✓ Perform experiments to learn Newton's laws and thermodynamic laws.
- ✓ Design experiments.
- ✓ Get familiar with physical measurement equipment.
- ✓ Analyze data and make conclusions.

REQUIRED STUDENT RESOURCES

Textbooks:

1- Halliday D., Resnick R., Walker J., Fundamentals of physics. 9th Edition, John Wiley & Sons: 2011. 1330 p.

References:

1- Cutnell J.D., Johnson K.W., Young D., Stadler S., Physics. 10th Edition, John Wiley & Sons: 2014. 992 p.

2- Bueche F.J., Hecht E., Schaum's Outline of College Physics, 11th Edition, McGraw-Hill, 2011.

Web links: -

Computer Software:

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	Measurement test and calculate errors.
2	Motion test in one dimension and one plane.
3	Particle dynamics experiment.
4	Work and energy conservation experiment.
5	Rotational kinematic and dynamic experiment.
6	Impact test.
7	Measurement of temperature and heat and study the zero, 1^{st} and 2^{nd} laws of thermodynamics.

EVALUATION PROCEDURES AND GRADING CRITERIA

Indicate how students are evaluated, including tests, quizzes, papers, assignments, the weight of the assignments, etc. Identify how the course grades are determined, clearly.

Lab report 1	5 points
Lab report 2	5 points
Lab report 3	5 points
Lab report 4	5 points
Lab report 5	5 points
Lab report 6	5 points
Lab report 7	5 points
Attendance at the laboratory	15 points
Final Exam	50 points
Total Points	100 points

ATTENDANCE STATEMENT

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SYLLABI ON WEB PAGES

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ENGINEERING DRAWINGS

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Engineering Drawings, S1

Number of credits: 2

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
1 h	-	2 h	-

COURSE OBJECTIVES

Familiarization of students with the general principles of technical drawing and building planning.

REQUIRED STUDENT RESOURCES

REFERENCES:

1. "ASME Standards", American Society of Mechanical Engineering, 4th Edition, John Wiley and Sons, 1998.
2. D. A. Madsen, “Engineering Drawing and Design”, 4th Edition, Delmar Cengage Learning, 2006.
3. D. A. Madsen and D. P. Madsen, Engineering drawing and design. Cengage Learning, 2016.
4. C. H. Jensen, J. D. Helsel and D. Short, “Engineering Drawing and Design”, 7th Edition, McGraw Hill Higher Education, 2007.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic	Reading /Assignment
1	Introduction	-
2	Getting to know the principles of technical drawing and display of parts	-
3	Anonymization in the conventional way without using mapping tools, then using them	-
4	Types of perspective (isometric, cavalier, two point)	-
5	Recognition of contractual signs in construction drawings and drawings of electrical and mechanical facilities	-
6-16	Drawing training: Beam plan, foundation and details of different building parts, elevations, sections, details related to steel and concrete structures, details related to the cross-section of ballasted and non-ballasted railway line pavement, details related to the cross-section of railway and subway tunnels, details Drawing the plan and profile of the railway track, detailing the drawing of the drainage of the railway track, drawing the details of the railway paving equipment including rails, fasteners, sleepers, etc., drawing the details of the reinforcement of the sleeper and the pavement, computer drawing with related software such as AutoCAD.	-

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (50%), Midterm (0%), Final (40%)

ATTENDANCE STATEMENT

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SYLLABI ON WEB PAGES

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SURVEYING THEORY & PRACTICE

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Surveying Theory & Practice, S2

Number of credits: 2

COURSE PREREQUISITES:

Mathematics I

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Surveying and Geomatic Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
1 h	-	2 h	-

COURSE OBJECTIVES

Students are expected to:

- ✓ Familiarization of students with different methods of map preparation through direct ground measurement, as well as checking the accuracy and knowledge of equipment and types of maps and their standard of use in engineering.

REQUIRED STUDENT RESOURCES

Textbooks:

-

References:

1-M. Diantkhah, "Engineering Surveying ", Publications of Isfahan University of Technology, 2004.
2- Country Management and Planning Organization, " Surveying Instructions", 2003.
3- J. R. Wirshing, "Introductory surveying", McGraw-Hill, 1985.
4- A. Bannister and R. Baker, "Solving Problems in Surveying", 2nd Edition, Longman, 1990.
5- D. Wolf and C.Ghilani, "Elementary Surveying", 10th Edition, prentice- Hall, 2001.

Web links: -

Computer Software:

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	Familiarity with different branches of surveying
2	Examining the types of errors and an introduction to their publication
3	A brief overview of cartography principles and understanding the types and standards of maps
4	Familiarity with image systems
5	Methods of direct measurement of length
6	Methods of direct measurement of length
7	Alignment
8	Angle measurement and extension determination
9	Indirect methods of length measurement
10	Surveying and triangulation: determination of coordinates
11	A summary of the intersection
12	Tachometry and taking details
13	Carrying out field operations including: preparing a map with a scale of 1/1000 of a relatively flat and limited area
14	Carrying out field operations including: preparing a map with a scale of 1/1000 of a relatively flat and limited area
15	Extracting various cross-section profiles and calculating the area and volume from the map and implementing the map on the ground
16	Extracting various cross-section profiles and calculating the area and volume from the map and implementing the map on the ground

EVALUATION PROCEDURES AND GRADING CRITERIA

Indicate how students are evaluated, including tests, quizzes, papers, assignments, the weight of the assignments, etc. Identify how the course grades are determined, clearly.

Projects	40 points
Final Project	60 points
Mid-Term Exam	30 points
Final Exam	70 points
Total Points	200 points

ATTENDANCE STATEMENT

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SYLLABI ON WEB PAGES

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CONSTRUCTION MATERIALS AND CONCRETE TECHNOLOGY

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Construction Materials and Concrete Technology, S3

Number of credits: 3

COURSE PREREQUISITES:

COURSE CO-REQUISITES:

Strength of Materials

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	1 h

COURSE OBJECTIVES

Familiarity with the characteristics of various construction materials and knowing the properties of concrete and the correct way of making and using.

REQUIRED STUDENT RESOURCES

REFERENCES:

1. E. Allen and J. Iano, Fundamentals of building construction: materials and methods. John Wiley & Sons, 2019.
2. D. Doran and B. Cather, Construction materials reference book. Routledge, 2013.
3. A. Lyons, Materials for architects and builders. Routledge, 2014.
4. G. D. Taylor, Materials in construction: An introduction. Routledge, 2013.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic	Reading /Assignment
1-	-Introduction, importance and role of building materials in construction - Metal materials, structure, resistance properties, modulus of elasticity, increase in resistance, corrosion, brittleness, fatigue, etc.	-
2	-Wood, production sources, physical and resistance properties, environmental and chemical effects, wood protection, applications, types of wood. - Plaster and lime, production methods, physical and chemical properties and resistance, different types of applications	-
3	Mortars, production and properties of different mortars such as lime slag, lime sand, cement and their application - Bricks and ceramics, raw materials and production, classification and types of bricks, different properties, brick tests, different works	-
4	- Cement, cement chemistry, production, physical, chemical and mechanical properties, cement tests, application of various types of cements - Stone, types of stones, identification of stones, different properties, different uses	-
5	- Bitumen and asphalt, production methods, different properties, bitumen and asphalt tests, application - Insulation, thermal and moisture insulation in the building, practical materials, properties	-
6	Polymer, structure, technology, mechanical, thermal and durability properties of polymers, types of polymers and their application in the construction industry	-
7	Glass, production methods, different properties, types of glass, applications in the construction industry	-
8-16	Concrete, definition, aggregate, water, additives, properties, implementation, mixing plan, processing, damage and durability of concrete	-

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (20%), Midterm (35%), Final (35%)

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SYLLABI ON WEB PAGES

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CONSTRUCTION MATERIALS & CONCRETE LAB

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Construction Materials & Concrete Lab, S4

Number of credits: 1

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

Construction Materials and Concrete Technology

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
-	-	2h	-

COURSE OBJECTIVES

The main goal of the course is to conduct some experiments related to the course of concrete technology and construction materials by students.

REQUIRED STUDENT RESOURCES

Textbooks and References:

1- M. Shetty and A. Jain, Concrete Technology (Theory and Practice), 8e. S. Chand Publishing, 2019.
2- D. Doran and B. Cather, Construction materials reference book. Routledge, 2013.
3- A. Lyons, Materials for architects and builders. Routledge, 2014.
4- G. D. Taylor, Materials in construction: An introduction. Routledge, 2013.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	Cement: determination of specific weight, hardening time, normal mortar and tests of compressive and tensile and bending strength
2	Cement: determination of specific weight, hardening time, normal mortar and tests of compressive and tensile and bending strength
3	Aggregate: determination of specific gravity, water absorption, granulation, wear or Los Angeles, crushing and impact factor
4	Aggregate: determination of specific gravity, water absorption, granulation, wear or Los Angeles, crushing and impact factor
5	Measuring concrete efficiency and determining the amount of bubbles in concrete, Slump
6	Measuring concrete efficiency and determining the amount of bubbles in concrete, Slump
7	Measuring concrete efficiency and determining the amount of bubbles in concrete, Slump
8	Design and construction of concrete: concrete mixing design, concrete construction, various implementations
9	Design and construction of concrete: concrete mixing design, concrete construction, various implementations
10	Design and construction of concrete: concrete mixing design, concrete construction, various implementations
11	Determination of specific weight and indirect compressive and tensile strengths and bending of concrete
12	Determination of specific weight and indirect compressive and tensile strengths and bending of concrete
13	Determination of specific weight and indirect compressive and tensile strengths and bending of concrete
14	Familiarity with core removal and non-destructive testing of concrete
15	Concrete mixing ratios
16	Concrete mixing ratios

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (-), Project (75%), Midterm (-), Final Project (25%)

ATTENDANCE STATEMENT

The main goal of the course is to conduct some experiments related to the course of concrete technology and construction materials by students.

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SYLLABI ON WEB PAGES

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GENERAL WORKSHOP

BASIC INFORMATION

Place in Curriculum, title and semester: Core, General Workshop, S6

Number of credits: 1

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
-	-	32h	-

COURSE OBJECTIVES

Getting to know different workshop equipment and learning how to use them.

REQUIRED STUDENT RESOURCES

Textbooks and References:

1- Salimi, Yeganeh Pour, and Farahani, Machine Workshop, Payamnoor, 2020
2- R. R. Kibbe, J. E. Neely, R. O. Meyer, W. T. White, M. Bonkoski, and P. Bradshaw, Machine Tool Practices, 9th Edition, Prentice Hall, 2009.
3- H. A. Youssef, and H. El-Hofy, Machining technology: machine tools and operations, CRC Press, 2008.
4- M. Sahoo, and S. Sahu, Principles of Metal Casting, 3rd Edition, McGraw-Hill, 2014.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	Familiarity with general tools in the workshop
2	Familiarity with general tools in the workshop
3	Getting to know and work with tools and equipment in the machine tool department
4	Getting to know and work with tools and equipment in the welding department
5	Getting to know and work with tools and equipment in the modeling and casting sector
6	Getting to know and work with tools and equipment in the modeling and casting sector
7	Getting to know and work with tools and equipment in the sheet metal sector
8	Getting to know and work with tools and equipment in the sheet metal sector
9	Getting to know and work with drilling tools and equipment
10	Getting to know and work with sawing tools and equipment
11	Getting to know and work with sawing tools and equipment
12	Getting to know and work with turning tools and equipment
13	Getting to know and work with milling tools and equipment
14	Getting to know and work with milling tools and equipment
15	Getting to know and work with grinding tools and equipment
16	Getting to know and work with grinding tools and equipment

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (50%), Midterm (15%), Final (25%)

ATTENDANCE STATEMENT

Getting to know different workshop equipment and learning how to use them

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SYLLABI ON WEB PAGES

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STATICS

BASIC INFORMATION
Place in Curriculum, title and semester: Core, Statics, S2

Number of credits: 3

COURSE PREREQUISITES:
General Mathematics I

COURSE CO-REQUISITES:
-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	1 h	-	1 h

COURSE OBJECTIVES

Familiarize students with different elements used in railway engineering mechanisms and familiarity with how to analyze bodies in equilibrium in two or three dimensions.

REQUIRED STUDENT RESOURCES

Textbooks and References:

1. J. L. Meriam and L.G. Kraige, Engineering Mechanics – Statics, 4th Edition, John Wiley and Sons, 2011.
2. R.G. Hibbeler, Engineering Mechanics–Statics, 13th Edition, Pearson Prentice Hall, 2010.
3. F. Beer, E. Johnston, and D. Mazurek, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Hill US Higher Ed., 2019.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	An overview of quantities, vector algebra, newton's laws, system of units
2	evaluating the resultant of the forces, equilibrium laws, moment about a point and moment about axis
3	cross and dot product of vectors, couple, the resultant of a system of forces, evaluating equivalent force
4	Parallel force system, general force system, Rigid bodies equilibrium equations, evaluating supporting forces, static equilibrium conditions, statically indeterminate and constraints
5	Structures: trusses, two-force members, Method of joints and Method of sections, frames and machines
6	Structures: trusses, two-force members, Method of joints and Method of sections, frames and machines
7	Distributed forces: the mass center and the centroids center of a composite bodies and figures
8	Distributed forces: the mass center and the centroids center of a composite bodies and figures
9	Beams: evaluating internal forces, shear-force and bearing-moment diagrams
10	Relationships between shear force and bending moment and distributed load
11	Cables: under concentrated lateral loads, distributed loads (parabolic and catenary)
12	Area moments and products of inertia: Integration method, parallel axes transfer theorem, composite area
13	Friction: Dry friction laws, friction angle, wedge, screws, bearings, disks, rolling, belt
14	Friction: Dry friction laws, friction angle, wedge, screws, bearings, disks, rolling, belt
15	Virtual work and energy method: work of a force, virtual displacements, virtual displacements
16	The main Application of virtual work in machines, potential energy, stability in equilibrium position

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (5%), Project (10%), Midterm (35%), Final (50%)

ATTENDANCE STATEMENT

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SYLLABI ON WEB PAGES

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STRENGTH OF MATERIALS

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Strength of Materials, S3

Number of credits: 3

COURSE PREREQUISITES:

Statics

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	1 h	-	1 h

COURSE OBJECTIVES

Students are expected to:

- ✓ Understand the concept of stress and strain and the types of them.
- ✓ Analyze a given problem to calculate its internal stresses.
- ✓ Identify the types of loading and stresses and strains caused by each one.

REQUIRED STUDENT RESOURCES

Textbooks and References:

1. Popov E. Engineering Mechanics of Solids. 6th edition. Prentice-Hall; 2006.
2. Beer F., Johnson E., DeWolf J., Mazurek D. Mechanics of Materials. 7th edition. McGraw-Hill; 2014.
3. Hibbeler R. Mechanics of Materials. 7th edition. Prentice-Hall; 2007.
4. Gere J., Goodno B. Mechanics of Materials. 7th edition. CL-Engineering; 2008.

Web links: -

Computer Software:-

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	The concept of stress, the definition of stress, types of stress, the tensor of stress, normal and shearing stresses, stress in connections
2	Stress on an oblique plane, stress under general loading conditions, components of stress, the factor of safety
3	Definition of strain, normal strain, stress-strain diagram, true stress and true strain
4	Hooke's law, modulus of elasticity, elastic versus plastic behavior of a material, statically indeterminate problems
5	a problem involving temperature changes, Poisson's ratio, generalized Hooke's law
6	bulk modulus, shearing strain, plastic deformations, residual stresses
7	The concept of torsion, stresses and deformations in a circular shaft, angle of twist in the elastic range, statically indeterminate shaft
8	Stress concentrations in the circular shaft, plastic deformation, shafts made of an elastoplastic material, residual stresses
9	Torsion of noncircular members, thin-walled hollow shafts
10	Symmetric member in pure bending, stresses and deformations in the elastic range, bending of members made of several materials
11	Beams made of an elastoplastic material, residual stresses, axial loading in a plane of symmetry
12	Unsymmetrical bending, the general case of eccentric axial loading, bending of curved members, Load, shear, and bending moment in a beam and their relationships
13	Using singularity functions to determine shear and bending moment in a beam
14	Shearing stresses in a beam, shearing stresses in thin-walled members
15	Shear center, Loading combination
16	The concept of stress, the definition of stress, types of stress, the tensor of stress, normal and shearing stresses, stress in connections

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (5%), Project (10%), Midterm (35%), Final (50%)

ATTENDANCE STATEMENT

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SYLLABI ON WEB PAGES

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STRUCTURAL ANALYSIS

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Structural Analysis, S4

Number of credits: 3

COURSE PREREQUISITES:

Strength of Materials

COURSE CO-REQUISITES:

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	1 h	-	1h

COURSE OBJECTIVES

Learning the basic concepts of analysis of structures and forces calculating in structures

REQUIRED STUDENT RESOURCES

Textbooks and References:

1- R. C. Hibbeler, “Structural Analysis”, 8th Edition, Prentice-Hall, New Jersey, 2011.
2- Y. Y. Hsieh, “Elementary Theory of Structures”, Prentice-Hall, New Jersey, 1982.
3-C. H. Norris, J. B. Wilbur and S. Utku, “Elementary Structural Analysis”, 3rd Edition, McGraw-Hill, Auckland, 1976
.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	Familiarity with the analysis and design and their application, the principle of superposition
2	Familiarity with the analysis and design and their application, the principle of superposition
3	Structural systems, the concept of stability of structures, static determinacy and indeterminacy
4	Analysis of determinate structures, a: truss systems b: frame systems
5	Deformation of structures, elastic load method, conjugate beam and conjugate structure
6	The concept of virtual work, the method of virtual work and its application in calculating the deformation of structures
7	The concept of virtual work, the method of virtual work and its application in calculating the deformation of structures
8	Unit load method
9	Energy methods, the concept of strain energy and potential energy theorems (Castigiano theorem, Angser theorem, minimum complementary energy)
10	The use of energy methods in calculating the deformation of structures
11	Application of energy methods in the analysis of indeterminate structures
12	Analysis of indeterminate structures - force method
13	Analysis of indeterminate structures - the displacement method, the concept of stiffness - the method of moment distribution, the Slope-Deflection Method
14	The concept of moving load and line of influence - line of influence of certain structures - trusses, line of influence of certain beams and frames
15	Influence line of indeterminate structures - application of virtual work method and Müller-Breslav theorems
16	Methods of approximate analysis of structures

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (5%), Project (10%), Midterm (35%), Final (50%)

ATTENDANCE STATEMENT

The course instructor must clearly inform students on the first day of class and in writing in the syllabus of their (1) policy regarding class absence and (2) policy, if any, for making up missed assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

STUDENTS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS STATEMENT

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APPROVED ACADEMIC HONESTY STATEMENT

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SYLLABI ON WEB PAGES

Syllabi presented on web pages shall contain the date of last update.

MATERIALS SCIENCE AND KNOWLEDGE OF METALS IN THE RAILWAY

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Material Science and Knowledge of Metals in the Railway, S5

Number of credits: 2

COURSE PREREQUISITES:

Strength of Materials

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
2 h	-	-	-

COURSE OBJECTIVES

Getting to know the microscopic structure of materials and metals. Knowing the properties of metals with different analyzes and getting familiar with the processes of heat treatment and the use of materials.

REQUIRED STUDENT RESOURCES

Textbooks and References:

1-Materials Science and Engineering: An Introduction ,William D. Callister Jr., David G. Rethwisch ,2018
2-The Fundamentals of Corrsion ,J,C Scully pergammon press 1975\
3-Introduction to Mechanical Properties of Materials , M.M Eisenstaddt, Macmillan,1971

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	Mechanical, thermal, and magnetism properties of various industrial materials and the relationship between the structure and properties of such materials, an overview of chemical connections, bonding and strong non-bonding forces, molecules, bonding and non-bonding forces
2	Mechanical, thermal, and magnetism properties of various industrial materials and the relationship between the structure and properties of such materials, an overview of chemical connections, bonding and strong non-bonding forces, molecules, bonding and non-bonding forces
3	Atomic arrangement in solids, tellurium, crystal systems, cubic crystals, hexagonal crystals, polymorphism,
4	Irregularity in solids, impurities in solids, dislocations in crystals, grain boundary arrangement defects
5	Structure and properties of multiphase metallic materials, qualitative relations of phases, diagram of phases, chemical composition of phases, amounts of phases
6	Structure and properties of multiphase metallic materials, qualitative relations of phases, diagram of phases, chemical composition of phases, amounts of phases
7	Phases of iron and carbon system, reactions of solid phases, heat treatment, hardenability, application and selection of metals
8	Ceramic materials and their properties, ceramic crystals, silicates, glasses, refractory materials, cement, porcelain
9	Ceramic materials and their properties, ceramic crystals, silicates, glasses, refractory materials, cement, porcelain
10	Knowing the properties of non-metallic and non-metallic materials, polymers, natural rubber, vulcanization, mechanical properties of polymers
11	Knowing the properties of non-metallic and non-metallic materials, polymers, natural rubber, vulcanization, mechanical properties of polymers
12	Corrosion in materials, corrosion in metals, electrochemical principles, corrosion rate and its measurement methods,
13	Corrosion in materials, corrosion in metals, electrochemical principles, corrosion rate and its measurement methods,
14-15-16	Non-alloyed steels: iron-carbon alloys, iron-carbon equilibrium diagram and explanations and phases in it, T-T diagram, Gemini test, heat treatment, surface hardening. Alloy steels: the effect of alloying elements in iron, the effect of alloying elements in the plating capabilities of steels, cast irons, white, gray, ductile, malleable, non-ferrous metals, identification and application of copper and aluminum alloys

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (5%), Project (10%), Midterm (35%), Final (50%)

ATTENDANCE STATEMENT

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SYLLABI ON WEB PAGES

Syllabi presented on web pages shall contain the date of last update.

DESIGN OF REINFORCED CONCRETE STRUCTURES

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Design of reinforced concrete structures, S5

Number of credits: 3

COURSE PREREQUISITES:

Construction Materials & Concrete Technology
Structural Analysis

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	1 h	-	1h

COURSE OBJECTIVES

Familiarizing students with the principles of designing concrete structures

REQUIRED STUDENT RESOURCES

Textbooks and References:

1.C. Meyer, “Design of Concrete Structures”, 1st Edition, Prentice Hall, 1995.
2.J. C. McCormac and R. Brown, “Design of Reinforced Concrete”, 8th Eidtion, Wiley, 2008.
3.A. Nilson, D. Darwin and C. Dolan, “Design of Concrete Structures”, 14th Eidtion, McGraw-Hill Science/Engineering/Math, 2009.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	Compressive strength, classification, resistance acceptance criteria, tensile strength, deformation of concrete under the effect of load
2	Reinforced concrete, types of steel used in reinforced concrete, classification of steel in terms of ductility, mechanical characteristics of steel
3	Different design methods in reinforced concrete structures
4	Analysis of the behavior of reinforced concrete beams in uncracked, elastic and limit states and in different stages of loading
5	Analysis of the behavior of reinforced concrete beams in uncracked, elastic and limit states and in different stages of loading
6	Determining the resistant bending moment of beams, determining the ultimate resistant moment, balanced section, compression reinforcement,
7	Design of beams for shear: the behavior of beams under the effect of shear force, beam resistance against shear without transverse bars,
8	Getting to know the behavior and design principles of reinforced concrete beams against torsion
9	Compressive strength, classification, resistance acceptance criteria, tensile strength, deformation of concrete
10	Compressive strength, classification, resistance acceptance criteria, tensile strength, deformation of concrete
11	Theory of adhesion of concrete and steel, restraint of steel, cutting of rebar, criteria of steeling, beams
12	Creep and cracking: calculation of creep, immediate and long-term creep, limitation of creep, cracking
13	Creep and cracking: calculation of creep, immediate and long-term creep, limitation of creep, cracking
14	Familiarization with various load-bearing systems of the roof and coverings and types of slabs, analysis and design of one-sided slabs and Joist systems, checking the criteria and reinforcing in slabs - basics of designing double-sided slabs
15	Familiarization with various load-bearing systems of the roof and coverings and types of slabs, analysis and design of one-sided slabs and Joist systems, checking the criteria and reinforcing in slabs - basics of designing double-sided slabs
16	Components under pressure and bending (columns), column analysis, column axis, analysis at the ultimate limit and interference diagram of load and moment

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (5%), Project (10%), Midterm (35%), Final (50%)

ATTENDANCE STATEMENT

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assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

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SYLLABI ON WEB PAGES

Syllabi presented on web pages shall contain the date of last update.

DESIGN OF STEEL STRUCTURES

BASIC INFORMATION
Place in Curriculum, title and semester: Core, Design of Steel structures, S5

Number of credits: 3

COURSE PREREQUISITES:
Structural Analysis

COURSE CO-REQUISITES:
-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	1 h	-	1h

COURSE OBJECTIVES

Familiarization of students with the rules of design of steel structures.

REQUIRED STUDENT RESOURCES

Textbooks and References:

1. S. G. Salmon, and J. E. Johnson, “Steel Structures: Design and Behavior”, 4th Edition, Prentice-Hall, New York, 1997.
2. E. H. Gaylord, and C. N. Gaylord, “Design of Steel Structures”, 3rd Edition, McGraw-Hill, New York, 1992.
3. “Specification for Structural Steel Buildings (AISC 2005)”, American Institute of Steel Construction (AISC), Illinois, 2005.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	Principles of designing structures, loads on structures, design standards, design regulations
2	Principles of designing structures, loads on structures, design standards, design regulations
3	Characteristics of structural steels, steel behavior (stress-strain diagram, heat effect, fatigue, brittleness, weathering), screw steels, welding electrodes, structural steel profiles
4	Characteristics of structural steels, steel behavior (stress-strain diagram, heat effect, fatigue, brittleness, weathering), screw steels, welding electrodes, structural steel profiles
5	Design of tensile members: classification of tensile members, design criteria of tensile members, total cross-sectional area, net cross-sectional area, effective net cross-sectional area, slenderness limits, composite (constructed) tensile members
6	Design of tensile members: classification of tensile members, design criteria of tensile members, total cross-sectional area, net cross-sectional area, effective net cross-sectional area, slenderness limits, composite (constructed) tensile members
7	Design of compression members: stability of compression members, effective length of columns, slender limits
8	Design of compression members: stability of compression members, effective length of columns, slender limits
9-10-11-12	Design of bending members: bending of compressed and non-compressed sections with and without sufficient lateral support, shearing in beams, transverse reinforcement plates, concentrated loads on beams, compression plates, bending plates of beam wings, changing the location of beams, portal beams , biaxial bending, lateral braces
13-14	Designing members under the combined effect of axial pressure and bending (beams and columns), members under the combined effect of axial tension and bending
15-16	Designing of column baseplate.

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (5%), Project (10%), Midterm (35%), Final (50%)

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SYLLABI ON WEB PAGES

Syllabi presented on web pages shall contain the date of last update.

SOIL MECHANICS

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Soil Mechanics, S4

Number of credits: 3

COURSE PREREQUISITES:

Strength of Materials

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3h	-	-	1h

COURSE OBJECTIVES

Familiarization with the basic principles, foundations, and preliminary concepts of soil behavior based on their physical and mechanical properties, with emphasis on applications in engineering problems.

Students are expected to:

- ✓ Assess the performance of the weight and volume parameters and their relationships in soil
- ✓ Acquaintance with total stress and water pressure in saturated soils
- ✓ Investigation of Stability of slopes and embankments

REQUIRED STUDENT RESOURCES

List books, lab manuals, technology, supplies, calculators, and any other materials required or recommended for the student to complete the course requirements.

Textbooks and References:

1. B. M. Das, “Principles of Geotechnical Engineering, Vol. 1: Soil Mechanics”, 2th Edition, PWSKent, Boston, 1990.

2. J. K. Mitchel, “Fundamentals of Soil Mechanics”, John Wiley, 1976.

3. K. Terzaghi and R. B. Peck, “Soil Mechanics in Engineering Practice”, 2 th Edition, John Wiley, 1967.

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

1. Generalities and definitions of soil formation and structure,including weight and volume parameters and their relationships in soil.

2. Identifying and classifying soils, examining classification criteria, introducing common classification methods and explaining the application of these methods in engineering projects.

3. Compaction of soils, principles and rules governing soil compaction, the role of energy consumption in compaction, theoretical curve of compaction.

4. Soil drainage: definition of water flow in soil, Darcy's law, soil permeability coefficient and its measurement methods.

5. Effective stresses, total stress and water pressure in saturated soils

6. Shear resistance of soils, stability in soils, stress path, determination of rupture plane in limit states.

7. Elastic expansion of soil stress, pressure distribution under different foundations, co-pressure curves of approximate pressure distribution

8. Consolidation of soils: description of consolidation model and settlement mechanism due to consolidation, Terzaghi's consolidation theory, mathematical equations of soil consolidation, time relations of consolidation, pre-consolidation pressure, effect of construction time on consolidation settlement, rapid settlement.

9. Stability of slopes and embankments: stability of sandy slopes in dry and saturated conditions, stability of clay slopes.

10. Landslide: study of landslide (pressure) static, active and resistant states, the effect of deflections in landslide states.

Week	Topic
1	Generalities and definitions of soil formation and structure
2	weight and volume parameters and their relationships in soil
3	Identifying and classifying soils
4	Compaction of soils
5	theoretical curve of compaction
6	Effective stresses, total stress and water pressure in soils
7	Effective stresses, total stress and water pressure in soils
8	Soil drainage
9	Shear resistance of soils
10	Elastic expansion of soil stress
11	Elastic expansion of soil stress
12	Terzaghi's consolidation theory
13	mathematical equations of soil consolidation
14	effect of construction time on consolidation settlement, rapid settlement

15	Stability of slopes and embankments
16	Stability of slopes and embankments

EVALUATION PROCEDURES AND GRADING CRITERIA

Indicate how students are evaluated, including tests, quizzes, papers, assignments, the weight of the assignments, etc. Clearly identify how the course grades are determined.

Assignment "A"	10 points
Assignment "B"	10 points
Assignment "C"	10 points
Assignment "D"	10 points
Comprehensive Assignment	80 points
Mid-Term Exam	120 points
Final Exam	160 points
Total Points	400 points

ATTENDANCE STATEMENT

The course instructor must clearly inform students on the first day of class and in writing in the syllabus of their (1) policy regarding class absence and (2) policy, if any, for making up missed assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

STUDENTS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS STATEMENT

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APPROVED ACADEMIC HONESTY STATEMENT

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SYLLABI ON WEB PAGES

Syllabi presented on web pages shall contain the date of the last update.

SOIL MECHANICS LAB

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Soil Mechanics Lab, S5

Number of credits: 1

COURSE PREREQUISITES:

Soil Mechanics

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
-	-	2h	-

COURSE OBJECTIVES

In this course, students will learn about soil mechanics experiments.

REQUIRED STUDENT RESOURCES

Textbooks and References:

1- B. M. Das, Principles of geotechnical engineering. Cengage learning, 2021.
2- B. M. Das and N. Sivakugan, Fundamentals of geotechnical engineering. Cengage Learning, 2016.
3- G. E. Blight, Unsaturated soil mechanics in geotechnical practice. CRC Press, 2013.
4- T. Schanz, Experimental unsaturated soil mechanics. Springer Science & Business Media, 2007.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	Sampling process
2	Sampling process
3	Granulation test (sieve, hydrometry
4	Granulation test (sieve, hydrometry
5	Etterberg's test
6	Compaction test
7	Compaction test
8	California freight sign
9	Sand equivalence test
10	Testing the relative density of granular soils
11	Experiment to determine the field specific gravity of the soil
12	direct shear test
13	tri-axial test
14	consolidation test
15	permeability test
16	Designing of column baseplate.

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (-), Project (75%), Midterm (-), Final Project (25%)

ATTENDANCE STATEMENT

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SYLLABI ON WEB PAGES

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GEOLOGY & ROCK MECHANICS

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Geology & Rock Mechanics , S7
Number of credits: 2

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

Soil Mechanics

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3h	-	-	-

COURSE OBJECTIVES

Getting to know the general concepts of geology and the application of rock mechanics.

Students are expected to:

- ✓ Assess overview of general geology and its applications in engineering
- ✓ Recognotion of stress in rocks, Mohr's circle for stress and Mohr's circle
- ✓ Investigating the effect of various factors on rock strength

REQUIRED STUDENT RESOURCES

List books, lab manuals, technology, supplies, calculators, and any other materials required or recommended for the student to complete the course requirements.

Textbooks and References:

1- R. B. Johnson and J. V. DeGraff, "Principles of Engineering Geology", John Wiley, 1988.

2- D. G. Price, "Engineering Geology: Principals and Practice", Springer, 2007.

3- A. Fahimi Far, M. Qaroni Nik, "Principles of rock mechanics in engineering operations", Amirkabir Publications, 1377

4- A. Fahimi Far, "Stone mechanics tests of theoretical foundations and standards", Amirkabir publication, 2012

5- M. Vefaian, "Stone engineering with theory and practical applications", Isfahan Arkan Publications, 1376

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

1. Geology: An overview of general geology and its applications in engineering, including geological foundations, internal formations of the Earth, the geological history of the Earth, processes of internal geodynamics such as erosion and sedimentation, petrology, rock weathering and its causes, a brief introduction to paleontology, structural geology, and soil classification.

2. Rock Mechanics: Stress in rocks, Mohr's circle for stress, definitions of longitudinal and shear strain, strain in a plane, Mohr's circle for strain, stress-strain relationships for elastic bodies and natural materials, three-dimensional strain, Rock and rock mass strength: joints, intact rock, shear strength of discontinuities, shear strength of planar surfaces, shear strength of rough surfaces, field estimation of JRC and JCS and their scale effects, shear strength of filled discontinuities, effect of water pressure, instantaneous cohesion and friction, strength of jointed rock masses. Rock failure: effect of various factors on rock strength, mechanism of rock fracture, rock failure criteria, Mohr's failure criterion, Coulomb's shear strength criterion, Griffith's failure criterion. In-situ stress measurement methods: natural stresses, induced stresses, methods for in-situ stress measurement, hydraulic fracturing method, flat jack method, USBM two-dimensional strain gauge, CSIRO triaxial strain cell, in-situ stress measurement without re-coring (Borehole Slotter), determination of physical and mechanical properties of rocks.

Week	Topic
1	An overview of general geology and its applications
2	Stress in rocks, Mohr's circle for stress
3	Mohr's circle for strain, stress-strain relationships
4	Mohr's circle for strain, stress-strain relationships in rock
5	Rock and rock mass strength
6	Rock and rock mass strength
7	Rock and rock mass strength
8	Rock failure: effect of various factors on rock strength
9	Rock failure: effect of various factors on rock strength
10	Rock failure: Mohr's failure criterion, Coulomb's shear strength criterion
11	Rock failure: Mohr's failure criterion, Coulomb's shear strength criterion
12	In-situ stress measurement methods
13	In-situ stress measurement methods
14	In-situ stress measurement methods
15	In-situ stress measurement without re-coring
16	In-situ stress measurement without re-coring

EVALUATION PROCEDURES AND GRADING CRITERIA

Indicate how students are evaluated, including tests, quizzes, papers, assignments, the weight of the assignments, etc. Clearly identify how the course grades are determined.

Assignment "A"	10 points
Assignment "B"	10 points
Comprehensive Assignment	120 points
Final Exam	260 points
Total Points	400 points

ATTENDANCE STATEMENT

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SYLLABI ON WEB PAGES

Syllabi presented on web pages shall contain the date of the last update.

ENGINEERING HYDROLOGY

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Engineering Hydrology, S4

Number of credits: 2

COURSE PREREQUISITES:

Statistics and Probability for Engineers

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge:
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
2 h	-	-	1 h

COURSE OBJECTIVES

This course is aimed at teaching students the concept of hydrology and computational analysis for the design and management of water resources projects. It gives a practical approach to the various facets of the subject and emphasizes the application of hydrological knowledge to solve engineering problems.

REQUIRED STUDENT RESOURCES

REFERENCES:

1. S. Eslamian, Handbook of engineering hydrology: fundamentals and applications. CRC Press, 2014.
2. V. P. Singh and D. Eng, Handbook of applied hydrology. McGraw-Hill Education, 2017.
3. M. M. Soleiman, Engineering Hydrology of Arid and Semi-Arid Regions, 2010.
4. A. Alizadeh, "Principles of Hydrology", Astan Quds Razavi Publications, 2017.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	Introduction of the concepts of engineering hydrology
2	Hydrology and water cycle
3	Atmospheric characteristics and meteorological elements
4	Air masses and fronts
5	Precipitation: the formation of precipitation and types of precipitation, measurement of precipitation including rain and snow measurement
6	Evaporation and sweating
7	Water penetration in the soil
8	Watershed and their characteristics
9	Hydrometry
10	Homogeneity and reconstruction of hydrological data
11	Surface runoff
12-13	Hydrograph and its analysis: hydrograph and its components, hydrograph analysis, flow continuity diagram and how to draw
14	Statistical methods in hydrology
15	Flood detection process: Flood detection process in tanks and rivers
16	Basics of drainage and channeling of surface water in railway lines

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (15%), Midterm (35%), Final (40%)

ATTENDANCE STATEMENT

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SYLLABI ON WEB PAGES

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PROJECT EVALUATION & COST ESTIMATION

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Project Evaluation & Cost Estimation, S6

Number of credits: 1

COURSE PREREQUISITES:

Semester 6 or later

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
2 h	-	-	-

COURSE OBJECTIVES

To provide basic knowledge of estimating and costing of civil engineering works; to analyze the rates and estimate the cost of various construction works.

REQUIRED STUDENT RESOURCES

REFERENCES:

1. Office of technical affairs and standards development, "List of basic unit price of buildings in the field of construction and industrial construction", Management and Planning Organization, 1402.
2. Office of Technical Affairs and Standards Development, "List of Basic Unit Prices for Road, Railway and Airport Runway, Road and Transportation", Management and Planning Organization, 1402.
3. D. Pratt, Fundamentals of construction estimating. Cengage Learning, 2018.
4. F. Harris, R. McCaffer, A. Baldwin, and F. Edum-Fotwe, Modern construction management. John Wiley & Sons, 2021

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	Introduction
2-3	Familiarity with types of contracts, holding tenders and contract conditions
4-5	Getting to know how to prepare price list booklets in the fields of buildings, roads and runways, railway infrastructure
6	Getting to know the relationship between the employer, consulting engineer and contractor and the duties of each
7	The method of measuring different types of construction works
8	Price analysis of various types of construction works
9	Estimation of one kilometer of railway construction including pavement, substructure in two cases inside the tunnel and on the embankment
10	The method of transferring the values obtained from the meter to the different parts of the corresponding first order and preparing the summary of the meter
11-16	Practical project: After teaching the above materials and familiarizing the students with the general principles of meter preparation and price analysis, the students are required to estimate a complete executive plan of the railway station, railway lines and structures or a building or a part of it and make their calculations like a Provide a definite situation.

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (50%), Midterm (0%), Final (40%)

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SYLLABI ON WEB PAGES

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DYNAMICS

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Dynamics, S3

Number of credits: 3

COURSE PREREQUISITES:

Statics

COURSE CO-REQUISITES:

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	1 h	-	1h

COURSE OBJECTIVES

Familiarity of students with methods of analyzing moving bodies in two or three dimensions.

REQUIRED STUDENT RESOURCES

Textbooks and References:

1. J. L. Meriam and L. G. Kraige, Engineering Mechanics – Dynamics, 4th Edition, John Wiley and Sons, 2012.
2. R. G. Hibbeler, Engineering Mechanics–Dynamics, 12 th Edition, Pearson Prentice Hall, 2010.
3. F. Beer, E. Johnston, and D. Mazurek, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Hill US Higher Ed., 2019.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	Dynamic of particles: Introduction and definitions of dynamics, vectors, matrices, newton's laws
2	Kinematics of particles: Definition of motion, rectilinear motion of particles, angular motion
3	Plane curvilinear motion, plane relative motion, space curvilinear motion, space relative motion
4	Kinetics of particles: Introduction, equations of motion, work and energy
5	Impulse and momentum, central-force motion,
6	Kinetics of systems of particles: Introduction, equations of motion, work and energy
7	Linear momentum and angular momentum, conservation of energy and momentum
8	Linear momentum and angular momentum, conservation of energy and momentum
9	Dynamics of rigid bodies
10	Plane kinematics of rigid bodies: Introduction, absolute motion, relative motion with axes translating and relative motion with axes rotation
11	Plane kinematics of rigid bodies: Introduction, absolute motion, relative motion with axes translating and relative motion with axes rotation
12	Plane kinetics of rigid bodies: Mass moments of inertia about an axis, mass and acceleration, work and energy, impulse and momentum
13	Plane kinetics of rigid bodies: Mass moments of inertia about an axis, mass and acceleration, work and energy, impulse and momentum
14	Space kinematics of rigid bodies: absolute motion and relative motion
15	Space kinetics of rigid body: Angular momentum, mass moment of inertia
16	Momentum and energy equations of motion, general plane motion, rotation about a point, general space motion

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (5%), Project (10%), Midterm (35%), Final (50%)

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SYLLABI ON WEB PAGES

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FLUID MECHANICS

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Fluid Mechanics, S6

Number of credits: 3

COURSE PREREQUISITES:

Dynamics

COURSE CO-REQUISITES:

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	1 h	-	1h

COURSE OBJECTIVES

Familiarity with the physical properties of fluids and relationships governing static and moving fluids

REQUIRED STUDENT RESOURCES

Textbooks and References:

1. V. L. Streeter, E. B. Wylie, and K. W. Bedford, “Fluid Mechanics”, WCB/McGraw Hill, 1998.
2. I. H. Shames, “Mechanics of Fluids”, McGraw-Hill Professional, 2002.
3. B. R. Munson, D. F. Young, and T. H. Okiishi, “Fundamentals of Fluid Mechanics”, 5th Edition, Wiley, 2005.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1-2-3	Physical properties of fluids include: Mass density, specific weight, specific volume, relative specific weight, Newton's law of viscosity, thermodynamic properties of fluids, compressibility and modulus of elasticity, surface tension and capillarity, vapor pressure and cavitation.
4-5	Static fluid mechanics
6	Fluid flow
7-8	Dimensional analysis and hydraulic models
9	Flow in pressurized pipes
10-11	External flow and forces acting on objects
12	Shear and compressive force
13-14	Boundary layer in external flow
15	Tensile force
16	Hydraulic force on structures and how to calculate

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (5%), Project (10%), Midterm (35%), Final (50%)

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SYLLABI ON WEB PAGES

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RAILWAY OPERATIONS AND TIMETABLING

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Railway operations and time-tabling, S3

Number of credits: 2

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
2h	-	-	-

COURSE OBJECTIVES

In this course, the students are expected to become familiar with the railway operation, general rules of train movement, and the duties instructions of the railway employee.

REQUIRED STUDENT RESOURCES

References:

1- V. A. Profillidis, Railway management and engineering, Ashgate; 3thedition, 2006.

2- Hansen, Ingo A., and Jörn Pachl, Railway Timetabling & Operations: Analysis, Modelling, Optimisation, Simulation, Performance Evaluation (2014).

3- I. A. Hansen, Timetable planning and information quality. WIT Press, 2010.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 13	Topic	Reading /Assignment
1	Familiarity with the operation management of the railway track of the Iranian rail network and the method of operation of the world's railways.	-
2-3	Familiarization with operation management in urban railway lines (subway, tram, etc.), with railway regulations in the railway network of Iran and the world, general information about the components and different parts of railway track, general information about stations, types of stations, station capacity, block and station operations and services.	-
4-5	Types of railway tracks inside the station, schedule of movement and acceptance and dispatch of trains, preparation of real and scheduled movement graph, familiarity with the sheet of movement, guide bar and electrical signals in obtaining entering permit.	-
6	Signs on the side of the rail and relevant technical specifications, placement of signs in stations and blocks, and concepts of signs.	-
7-8	Numbering methods of freight and passenger wagons and locomotives, the method of calculating speed and braking ratio in setting the train schedule, calculating the weight and braking ratio according to the maximum length of train	-
9-10	Sorting and forming the train, traffic control officer, maneuver and station officer, train officer, calculation of the number of locomotives, wagons and manpower required for operation	-
11	CPM related to the preparation of trains at passenger stations, central control tasks, block control	-
12	Basic familiarity with the concepts of blocking in the rail network and its types, the performance of operating officers in the signal system	-
13-14	Familiarization with headway and its effect on the movement of trains and the capacity of railway track, method of calculating the capacity of the track according to the capacity of maintenance depots, operation methods of increasing the capacity	-

15	Introducing railway operation simulation software, method of determining PPHPD in subway.	-
16	The method of determining the route capacity of in the subway network, method of routing and determining the lines of the rail transport network	-

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (15%), Project (15%), Midterm (20%), Final (50%)

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SYLLABI ON WEB PAGES

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BASIC OF ELECTRICAL ENGINEERING IN RAILWAY

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Basic of Electrical Engineering in Railway, S3

Number of credits: 3

COURSE PREREQUISITES:

Physics I: Mechanics and Heat

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	1 h	-	1 h

COURSE OBJECTIVES

In this course, the students are expected to become familiar with the main concepts of electrical engineering in order to have a correct understanding of the general operation of electrical subsystems in railway systems. Design and complex mathematical analyzes of electric circuits are not desired.

REQUIRED STUDENT RESOURCES

References:

1. R. C. Dorf and J. Svoboda, Introduction to electric circuits, Wiley, 2010.
2. S. J. Chapman, Electric machinery fundamentals, McGraw Hill, 2003.
3. W. Hayt J. Kemmerly, J. Phillips, and S. Durbin, Engineering Circuit Analysis, McGraw-Hill, 9th Edition, 2019.
4. L. O. Chua, Ch. A. Desoer, E. S. Kuh, Linear & Nonlinear Circuits, McGraw-Hill, 1987.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	Introduction of the concepts of electricity and magnetism
2	Familiarity with measuring devices (voltmeter, ammeter, and oscilloscope) and conducting preliminary tests of electric circuits
3	Introduction of electrical circuits including circuit components: resistance, inductor, capacitor, voltage and current sources, power and energy
4	Methods of solving electric circuits
5	First and second order circuits: RL circuit, RC circuit
6	Series and parallel RLC
7	Three-phase circuits, three-phase voltages and currents, three-phase voltage sources, analysis of simple three-phase circuits
8	Familiarity with measuring devices: measuring voltage, current, power, three-phase power
9-11	Familiarity with electric machines: ideal transformer, electric model of transformer, transformer performance, power losses in transformer, LPS, TPS, rectifier, operational investigation of the application of transformers in railways and subways
12	Considerations of high voltage and power transmission in ground transportation systems including electric railway substations, high voltage substations, traction substations, overhead connection networks, third rail system, cabling and related considerations
13	Stray current collection system
14	Grounding concepts of rail equipment including bonding and earth wells Introduction of insulators, insulation methods
15	Grounding and electromagnetic interference considerations
16	Wiring considerations in rail transport systems

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (0%), Midterm (40%), Final (50%)

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SYLLABI ON WEB PAGES

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RAIL ROUTE PLANNING AND DESIGN

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Rail Route Planning and Design, S4

Number of credits: 2

COURSE PREREQUISITES:

Surveying Theory & Practice

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
2h	-	-	-

COURSE OBJECTIVES

The objective of the course is to understand the fundamentals of railway route geometry design in a way that the traction power of the locomotives be able to compensate all of the resistance forces along the railway.

REQUIRED STUDENT RESOURCES

References:

1- Y. Sirong, Principles of railway Location and Design, Academic Press, 2017.
2- American Railway Engineering and Maintenance of Way Association, Manual for Railway Engineering, (2006), Volume 1, Chapter 5, “Track”.
3- European Committee for Standardization, (2002), EN 13803-1, Railway Applications – “Track Alignment Design Parameters-Track Gauges 1435 mm and Wider, Part 1: Plain Line”

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	A review on railway transport capacity and construction Standards
2	Traction calculation in railways
3	Railway plane design
4	Railway profile design
5	Plane and profile design at bridges, Culverts and tunnels
6	Plane and profile design at stations
7	Basic principles of railway route locating
8	Route locating in complicated geological conditions
9	Principles of railway environment route locating
10	Computer aided railway location and alignment design
11	Technical and economic comparison of schemes
12	Track layout design in Stations
13	Strengthening of the railway transport capacity
14	Railway right of way
15	A review on various codes and standards in rail route planning and design
16	Geometry design of switches and crossings

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (10%), Midterm (30%), Final (50%)

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SYLLABI ON WEB PAGES

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RAIL ROUTE PLANNING AND DESIGN LAB

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Rail Route Planning and Design Lab, S4

Number of credits: 1

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

Rail Route Planning and Design

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
-	-	1h	-

COURSE OBJECTIVES

The objective of the course is to understand the fundamentals of railway route geometry design in a way that the traction power of the locomotives be able to compensate all of the resistance forces along the railway.

REQUIRED STUDENT RESOURCES

References:

1- Y. Sirong, Principles of railway Location and Design, Academic Press, 2017.
2- American Railway Engineering and Maintenance of Way Association, Manual for Railway Engineering, (2006), Volume 1, Chapter 5, “Track”.
3- European Committee for Standardization, (2002), EN 13803-1, Railway Applications – “Track Alignment Design Parameters-Track Gauges 1435 mm and Wider, Part 1: Plain Line”

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1-2	Examining a real example of the plan and profile of the railway line
3-4	Prepare a topographic map and present it to the teacher and determine the mandatory points on the map by the teacher
5-7	Introducing all kinds of geometric design software for the railway track
8-10	Teaching the concepts of the geometric design of the railway track in one of the track design software including Civil 3D or other related software.
11-12	Route design including the longitudinal profile of the route, transverse profiles and geometric plan based on the topographical map provided by the professor. Preparing and presenting the volume of earthworks
13-15	Preparation of design drawings including plan, longitudinal profile and cross-sections, along with providing calculation notebooks for specifications of vertical and horizontal arches, slope and rise, elevation, Bruckner curve and volume of earthworks and determining the location of bridges, tunnels and tunnels along the route.
16	Designing a needlework sample and layout of a depot or railway station

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (-%), Project (100%), Midterm (-%), Final (-%)

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SYLLABI ON WEB PAGES

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RAILWAY FOUNDATION ENGINEERING

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Railway Foundation Engineering , S7

Number of credits: 3

COURSE PREREQUISITES:

Design of reinforced concrete structures
Soil Mechanics

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
2h	-	1h	-

COURSE OBJECTIVES

The objective of the course is to design various types of railway foundations

REQUIRED STUDENT RESOURCES

References:

1. B. M. Das, Principles of Foundation Engineering, 6th Edition, CL-Engineering, 2006.
2. B. M. Das, Principles of Foundation Engineering, Cengage Learning, 2015.
3. B. M. Das, Shallow foundations: bearing capacity and settlement. CRC press, 2017.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	The role of track substructure in railway track
2	An overview of the concepts of soil mechanics and stress distribution in soil mechanics, field geotechnical studies
3	Soil bearing capacity, settlement of foundations
4	Soil improvement methods
5	Structural design a) single foundation, structural design of foundations b) strip foundation, structural design of foundations c) wide foundation
6-7	Lateral pressure of the soil, retaining wall of the guard structure, investigation of the discussion of the lateral pressure of the soil (static state - driving state - resistant state) existing theories, types of retaining and retaining walls, advantages and limitations of each, methods of designing retaining walls, reinforced concrete retaining walls And the strapped back, its design and reinforcement method and the design of the buried walls.
8-9	Deep foundations, piles, Pile, introduction of types of piles, vertical and lateral bearing capacity, investigation of grouping phenomenon in piles and its effects on bearing capacity, applications of piles in railway bridges
10	Introduction of shields, types of shields and their designs
11	Designing galleries, drains, culverts and eyebrows
12	A summary of the discussion of line drainage, its methods and the design of a suitable drainage system
13	Designing a sample of retaining wall, pile and foundation based on loading and conditions of railway loads
14	An introduction to software simulations in foundation design
15-16	Project: The design of the structure of the road and the drainage of a road, the design of a retaining wall or the wall next to the bridge based on the existing hydrological and geotechnical specifications, and the provision of manual calculations and design software.

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (10%), Midterm (30%), Final (50%)

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SYLLABI ON WEB PAGES

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RAILWAY SUBSTRUCTURE DESIGN

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Railway Substructure Design, S5

Number of credits: 3

COURSE PREREQUISITES:

Soil Mechanics

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
2h	-	1h	-

COURSE OBJECTIVES

The objective of the course is to understand the role of substructure in the railway and designing a reliable substructure system.

REQUIRED STUDENT RESOURCES

References:

1. B. Indraratna, W.Salim, Advanced Rail Geotechnology - Ballasted Track, CRC Press,2011.
2. B. Indraratna, W. Salim, Mechanics of Ballasted Rail Tracks:A Geotechnical Perspective, Taylor and Francis,2005.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	The role of track substructure in railway track
2	Technical specifications of the infrastructure
3	An overview of infrastructure problems in normal and high-speed railway lines
4	Methods of implementation, maintenance and replacement, high behavior, introduction of tests in substructures
5-6	The specifications of the infrastructure layers and their types, determining the specifications and requirements of the top and the substrate
7	The influence of surface and underground water in the design of track and station infrastructure, line drainage and drainage design methods
8-9	Introduction of railway line construction and maintenance machines (digging, transporting and spreading machines)
10	Implementation of railway track infrastructure in problematic lands
11	An introduction to the use of numerical software in the design of railway infrastructure
12	Numerical software in the design of deep foundations, piles, retaining walls
13	Introduction to the principles of infrastructure in high-speed railway lines
14	An introduction to the methods of stabilizing the railway infrastructure
15-16	Project: carrying out the design of a path between two points, estimating the number of earthworks and consumables, upstream and downstream planning, drainage planning, estimating the desired building in the preliminary plan, designing a section of retaining wall, deep foundation or special foundation and drawing the CPM curve for the whole project

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (10%), Midterm (30%), Final (50%)

ATTENDANCE STATEMENT

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STUDENTS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS STATEMENT

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APPROVED ACADEMIC HONESTY STATEMENT

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SYLLABI ON WEB PAGES

Syllabi presented on web pages shall contain the date of last update.

RAILWAY SUPERSTRUCTURE DESIGN

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Railway Superstructure Design, S5

Number of credits: 3

COURSE PREREQUISITES:

Structural Analysis

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3h	-	-	-

COURSE OBJECTIVES

The objective of the course is to understand various track elements, their application and design.

REQUIRED STUDENT RESOURCES

References:

1- J. Mundrey, Railway track engineering. McGraw-Hill Education, 2009.
2- K. Tzanakakis, The railway track and its long term behavior: a handbook for a railway track of high quality. Springer Science and Business Media, 2013.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	The role of railway superstructure, types of superstructures, technical and general specifications of the track elements
2	Technical and general specifications of sleepers
3	The technical and general specifications of fastening systems
4	Technical and general specifications of the ballast and sub ballast
5	Technical and general specifications of the rail
6	Technical and general specifications of elastomers
7	Technical and general specifications of fishplates
8	Technical and general specifications of rail welding
9	Railway track load cases
10	Distribution of stresses and forces in the track components
11	Calculation of vertical, longitudinal and lateral forces on railway track
12	Determining the types of stresses created in the rails and their calculation.
13	Determining the forces on the sleepers, calculating the dimensions of the sleepers, the distance between the traverses
14	Determining the forces acting on the rail to traverse connection system, analysis, design and control of the connection system
15	Determining the forces and stresses on the top layer, analysis, design and control of the top layer
16	Common methods of track design, modeling of forces acting on the road

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (10%), Midterm (30%), Final (50%)

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SYLLABI ON WEB PAGES

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RAILWAY SUPERSTRUCTURE LAB

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Railway Superstructure Lab, S5

Number of credits: 1

COURSE PREREQUISITES:

Railway Superstructure Design

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
-	-	1h	-

COURSE OBJECTIVES

The objective of the course is to perform various test on railway components.

REQUIRED STUDENT RESOURCES

References:

1- S. Chandra, M. M. Agarwal, Railway Engineering , Oxford Higher Education, 2008.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	Stretching of metals, determining the hardness of metals
2	Resistance to impact, twisting in metal parts
3	Buckling of parts under pressure with different clamping conditions, asymmetric bending in beams and determination of cutting center
4	Continuous beam, thin wall cylinder
5	Familiarity with photoelasticity experiments
6	Getting to know the instruments for measuring changes in shapes
7	Familiarity with fatigue tests
8	Familiarity with the method of conducting quality control tests and technical specifications of rails, including composition tests
9	The method of performing quality control tests and technical specifications of all types of concrete, steel and wooden traverses
10	Familiarity with the method of performing quality control tests and technical specifications of bindings and the rail-to-traverse connection system
11	Familiarity with the method of conducting quality control tests and technical specifications is high and low
12	Familiarity with the method of conducting quality control tests and the technical specifications of rail welding
13	Familiarity with different tests of elastic layers and vibration reducing devices in the railway line
14	Familiarization with tests of insulating and normal connections
15	Familiarity with needle tests and crossovers
16	Getting to know the line hardness test

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (-%), Project (50%), Midterm (-%), Final (50%)

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SYLLABI ON WEB PAGES

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RAILWAY YARDS DESIGN AND MANAGEMENT

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Railway Yards Design and Managements, S6
Number of credits: 3

COURSE PREREQUISITES:

Railway Substructure Design
Railway Superstructure Design

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	-

COURSE OBJECTIVES

In this course, the students are expected to become familiar with the current standards and instructions of railway station track layout design, in addition, railway station equipment and facilities used in the railway and subway stations.

REQUIRED STUDENT RESOURCES

References:

1- L. M. Surhone, M. T. Timpledon, Railway Platform: Rail Tracks, Train Station, Tram Stop, Rail Siding, Bay Platform, 2010.

2- V. A. Profillidis, Railway management and engineering, Ashgate, 2016.

3- Iran statndards.

Web links: -

Computer Software: AutoCAD

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic	Reading /Assignment
1	Understanding the role of stations in railway transportation, an overview of the plan and specifications of important railway stations in Iran	-
2	Railway and subway stations parts, railway stations types	-
3	Railway station location problem, determination of railway station types , track types in the station, and the principles of geometric design	-
4	Station track plans types, railway track layouts and switching components types	-
5	Equation related to switches and crossing in stations and technical and safety principles in their placement	-
6	Geometric plan of station tracks, geometric specifications of switches and crossing components	-
7	Standards and regulations of geometric design	-
8	Railway technical stations (Passenger and Freight), Railway freight service facilities	-
9	Designing formation stations, yards and humps, train formation, shunting yard equipment	-
10	Calculation of the number of tracks in different areas of the station as well as siding tracks, service tracks, balloon loop	
11	Stations track layout plan to connect to warehouse buildings and areas	-
12	Abbreviations on railway maps and layouts	-
13	Basic principles of unloading and loading tracks of hazards goods and safety equipment	-
14	Station geometry types and track layouts in subway, subway station types	-
15	Methods of calculating the station capacity	-
16	Urban development considerations of stations and terminals, urban development plans, landscaping and architecture	-
17	Main and side service spaces of stations and considerations of architectural design, explanation of rules and standards of railway stations	-
18	Spaces and access ways of stations	-

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (12.5%), Midterm (22.5%), Final (55%)

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SYLLABI ON WEB PAGES

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RAILWAYS CONSTRUCTION

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Railways Construction, S7
Number of credits: 3

COURSE PREREQUISITES:

Railway Substructure Design
Railway Superstructure Design

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3h	-	1h	-

COURSE OBJECTIVES

To be familiar between various methods of railway construction.

REQUIRED STUDENT RESOURCES

References:

1- J. Mundrey, Railway track engineering. McGraw-Hill Education, 2009.
2- K. Tzanakakis, The railway track and its long term behavior: a handbook for a railway track of high quality. Springer Science and Business Media, 2013.

Web links: -

Computer Software: AutoCAD

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	Conventional types of rail systems: High speed rail, Heavy rail / Intercity rail, Commuter rail systems
2	Introducing the construction methods of railway lines
3-4	Description of the method of paneling, preparation of coupling and rail fastening, description of the method of continuous or traverse rail laying and rail and coupling machines
5	Introduction of mechanized machines related to maintenance, use of panel cranes and gantry cranes in rail laying
6	Description of the traverse device
7	Machines for correcting substructures, threshers, needle threshers, high regulators
8	Different welding methods and how to implement them and welding machines, description of the repair welding method
9	How to use long boom cranes in collecting old couplings
10	Machinery for the improvement of railway lines
11	Explaining different methods of rebuilding lines and related machines
12	Introduction of semi-mechanized and dual-purpose rail-road machines, description of multi-purpose machines
13	Principles and basics of light and heavy line measuring devices and machines
14	Management of linear mechanized machines
15	Description of machines for making lines without tops
16	Special and non-special equipment in railways

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (10%), Midterm (30%), Final (50%)

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SYLLABI ON WEB PAGES

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RAILWAYS TRACK MAINTENANCE

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Railways Track Maintenance, S8

Number of credits: 3

COURSE PREREQUISITES:

Railways Construction

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
2 h	-	1 h	-

COURSE OBJECTIVES

The objective of the course is to understand the fundamentals of railway track maintenance procedure in a way that the reliability, availability, and safety of the track be guaranteed.

REQUIRED STUDENT RESOURCES

Textbooks and References:

1- A. K. S. Jardine, A. H. C. Tsang, Maintenance, replacement, and reliability: theory and applications, CRC press, 2013.
2- K. Tzanakakis, The railway track and its long-term behavior: a handbook for a railway track of high quality. Springer Science and Business Media, 2013.

Web links: -

Computer Software:-

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1-2	Maintenance and repairs, necessities, goals and concepts.
3	Introduction of maintenance management and life cycle cost.
4-5	How maintenance operations are carried out in various railways around the world.
6-7	Determining the permissible values and acceptable tolerance for track errors.
8-9	Common failures in track components, geometric failures of the railway track, investigation of structural failures of the railway track
10-11	Investigating the geometric and structural failures of the track, common failures in the geometric characteristics,
12	Maintenance machineries
13	Instructions for the tamping
14	Stone blowing
15	Renewal of lines, repairs and maintenance of drains
16	Infrastructure maintenance, removal and cleaning of surface water channels

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (20%), Midterm (20%), Final (50%)

ATTENDANCE STATEMENT

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SYLLABI ON WEB PAGES

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ROLLING-STOCKS ENGINEERING

BASIC INFORMATION

Course prefix, title and semester: Rolling-stocks engineering, S8

Number of credits: 3

COURSE PREREQUISITES:

Railway Yards Design and management

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering

Office location:

Phone Number:

Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	40 min

COURSE OBJECTIVES

The aim of this course is to introduce and familiarize students with the structure of rolling stock, dynamic modeling of train lines and wagons, forces between wheels and rails, train behavior during acceleration, braking, and movement around curves, as well as train braking systems and brake calculations.

REQUIRED STUDENT RESOURCES

Textbooks:

List books, lab manuals, technology, supplies, calculators, and any other materials required or recommended for the student to complete the course requirements.

References:

1- A. A. Shabana, K. E. Zaazaa ,"Railroad Vehicle Dynamics: A Computational Approach", ,CRC Publication,2007.

2- S. Chandra, M.M. Agarwal, Railway Engineering, Oxford University Press, 2007.

3- AREA: Manual for Railway Engineering. American Railway Engineering Association.

4- S. Iwnick, "Handbook of Railway Vehicle Dynamics",CRC press, 2006.

5- A. H. Wickens, "Fundamentals of Rail Vehicle Dynamics ",Taylor& Francis, 2003.

Web links: -

Computer Software: Microsoft Office package

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week	Topic
1	Different types of wagons, bogies, and train sets
2	Components like suspension springs, bearings, and mechanical dampers
3	Wagon dampers and couplings
4	Types of locomotives, classifying locomotives based on axle arrangement (BO-BO, CO-CO, etc.)
5	Generator and traction motors
6	Wheel and rail profiles, coefficient of friction, force between wheel and rail
7	Resistances to train movement
8	Davis resistance for calculating the permanent resistance
9	Temporary resistances: Grade resistance
10	Traction force, the relationship between traction force and locomotive speed
11	Continuous speed in locomotives
12	Principles of Train Formation Plan (TFP)
13	Calculating train weight and length
14	Dynamic behavior of the train during acceleration and braking
15	Brake systems in wagons and locomotives
16	Braking ratio

EVALUATION PROCEDURES AND GRADING CRITERIA

Home works (5%), Project (15%), Midterm (30%), Final (50%)

ATTENDANCE STATEMENT

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STUDENTS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS STATEMENT

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SYLLABI ON WEB PAGES

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BRIDGE DESIGN I

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Bridge Design 1, S6

Number of credits: 2

COURSE PREREQUISITES:

Design of reinforced concrete structures
Design of steel structures
Engineering Hydrology

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	-

COURSE OBJECTIVES

Familiarity with the design methods of railway bridges and studies of different phases of bridge construction

REQUIRED STUDENT RESOURCES

Textbooks and References:

1- Tahouni, Bridge Design, Tehran University, 2009.
2-P. A. Shaw, Bridge Loads, Taylor & Francis, 2007.
3-J. F. Unsworth, Design of Modern Steel Railway Bridges, CRC Press ,2010.
4-W.-F. Chen and L. Duan, Bridge engineering handbook: construction and maintenance. CRC press, 2014.

Web links: -
Computer Software:-

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	Getting to know the components of bridges, classification of bridges, uses and applications and identification of bridge geometry, history of bridge construction
2	Technical and economic studies, site selection, geometry, structure, opening, bridge materials in terms of economic issues, hydrological studies in bridge construction, architecture and aesthetics of bridges
3	Bridge loading, earthquake effect on bridges
4	Bridge structure analysis and introduction of various analysis methods
5	Bridge deck analysis methods and getting to know the theory of layers and the applications of each
6	The concept of moving load and line of influence and how to obtain them
7	Design of metal bridges and familiarity with AASHTO and AISC bridge Code
8	Design of simple and compound I-shaped girder bridges
9	Design of box-girder bridges
10	Designing arthroscopic and truss bridges
11	Special design considerations for metal and arched bridges in the plan and side
12	Getting to know the basics of designing suspended bridges
13	General information about the construction and implementation of metal bridges - cutting, bending, drilling, connections, screws
14	The principles of welding and its effective factors, welding inspection, screwing methods, installation of parts on rails
15	Software modeling of a bridge sample
16	Software modeling of a bridge sample

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (5%), Project (10%), Midterm (35%), Final (50%)

ATTENDANCE STATEMENT

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SYLLABI ON WEB PAGES

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BRIDGE DESIGN 2

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Bridge Design 2, S7

Number of credits: 2

COURSE PREREQUISITES:

Bridge Design 1

COURSE CO-REQUISITES:

Earthquake Engineering

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	-

COURSE OBJECTIVES

Familiarity with the methods of designing railway bridges and different bridge construction studies.

REQUIRED STUDENT RESOURCES

Textbooks and References:

1- Tahouni, Bridge Design, Tehran University, 2009.
2-P. A. Shaw, Bridge Loads, Taylor & Francis, 2007.
3-J. F. Unsworth, Design of Modern Steel Railway Bridges, CRC Press ,2010.
4-W.-F. Chen and L. Duan, Bridge engineering handbook: construction and maintenance. CRC press, 2014.

Web links: -

Computer Software:-

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	Design of plane bridges and reinforced concrete bridges with beam and slab system
2	Design of prestressed bridges
3	Implementation methods of prestressed bridges, force control
4	Design of unreinforced and reinforced concrete arch bridges
5	Design of stone arch bridges
6	Design of stone arch bridges
7	Design of supporting systems and design of neoprenes
8	Design of piers
9	Track superstructure in railway bridges
10	Types of piles, geology and subsurface investigation
11	Bearing capacity, experiments, dynamic formulas of pile driving and examples
12	Drawing load graph, analysis of energy loss, static formulas and examples, necessary tests before driving piles, reliability coefficients, pile driving equipment, choice of piles and driving methods
13	Swelling and contraction of the soil due to piling, twisting during piling, crushing of piles, effects of piling on nearby structures
14	Introduction of the group of piles, the grouping phenomenon and its effects on the bearing capacity
15	Load distribution in piles, Pile group formation in bridge foundation
16	A review of static and dynamic pile loading field tests

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (5%), Project (10%), Midterm (35%), Final (50%)

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SYLLABI ON WEB PAGES

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TUNNEL AND UNDERGROUND SPACE ENGINEERING

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Tunnel and underground space engineering, S8

Number of credits: 2

COURSE PREREQUISITES:

Mechanics Of Materials
Geology & Rock Mechanics
Railway Substructure Design

COURSE CO-REQUISITES:

-s

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	-

COURSE OBJECTIVES

Familiarity with tunnels and underground spaces and different methods of analysis and implementation

REQUIRED STUDENT RESOURCES

Textbooks and References:

1-Madani, Tunnel Construction, Amirkabir University, 2013.
2-Niroumand, Tunnel Engineering, Naghoos, 2019.
3-J. T. Edwards, "Civil Engineering for Underground Rail Transport, 2015.
4-H. Zhu, M. Chen, Y. Zhao, and F. Niu, Stability assessment for underground excavations and key construction techniques. Springer, 2017.

Web links: -

Computer Software:-

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	The history of tunneling, famous railway tunnels and their construction methods, types of tunnels and underground space, applications
2	The history of tunneling, famous railway tunnels and their construction methods, types of tunnels and underground space, applications
3	Transverse profile section of tunnels, types of tunnels, two-story, circle, oval, special gauge tunnels, railway tunnel in the rock
4	Engineering, exploratory, geotechnical and geological study stages of tunnel construction
5	Types of tunnel execution methods (English drilling method, Austrian, German and Italian method, hole drilling method, fire work)
6	Types of tunnel execution methods (English drilling method, Austrian, German and Italian method, hole drilling method, fire work)
7	Tunneling methods (traditional, mechanized)
8	The method of tunnelings in a traditional way and by drilling and blasting, in a mechanized way (TBM and Rod header), in a way of digging and covering
9	Stress distribution in underground spaces
10	Experimental methods in tunnel analysis and calculation of tunnel coverage
11	Maintenance and operation of tunnels (drainage, insulation, ventilation, lighting, facilities, tunnel head)
12	Designing individual, multiple underground spaces with circular and egg-shaped sections
13	Tunnel geometric form and plan, tunnel in longitudinal profile, tunnel contact with ground and stone layers, optimal section
14	Different excavation methods
15	Different excavation methods
16	The basics of designing underground spaces, including underground metro stations, and the introduction of numerical design software for tunnels

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (5%), Project (15%), Midterm (30%), Final (50%)

ATTENDANCE STATEMENT

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STUDENTS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS STATEMENT

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APPROVED ACADEMIC HONESTY STATEMENT

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SYLLABI ON WEB PAGES

Syllabi presented on web pages shall contain the date of last update.

EARTHQUAKE ENGINEERING

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Earthquake Engineering, S6

Number of credits: 2

COURSE PREREQUISITES:

Structural Analysis
Dynamics

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	-

COURSE OBJECTIVES

In this course, students are introduced to the concepts of seismology, the principles of design earthquake determination, the usual methods of seismic analysis, and various types of structural resistant systems against earthquakes.

REQUIRED STUDENT RESOURCES

Textbooks and References:

1-A. Elnashai and L. D. Sarno, Fundamentals of Earthquake Engineering, Wiley, 2008.
2-Ö. Yilmaz, Engineering seismology with applications to geotechnical engineering. Society of Exploration Geophysicists, 2015.
3-R. W. Day, Geotechnical earthquake engineering handbook: with the 2012 International building code. McGraw-Hill Education, 2012.

Web links: -

Computer Software:-

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	Seismology: causes of earthquakes, phenomena associated with earthquakes, earthquake measurement scale, seismicity of Iran
2	Seismology: causes of earthquakes, phenomena associated with earthquakes, earthquake measurement scale, seismicity of Iran
3-4	The method of reducing the consequences of an earthquake: the mechanism of earthquake destruction, necessary measures to deal with earthquakes, possible earthquake damages in big cities, the role of insurance in reducing earthquake damages, the necessity of seismological studies in construction projects
5-6	Determining the design earthquake: effective factors on earthquake movements, the effect of the distance and characteristics of the soil in the area and the magnitude of the earthquake, earthquake studies in terms of the probability and risk of the earthquake, definitive and probable methods for determining the design earthquake
7-8	Equivalent static method to analyze structures against earthquakes: review of the basics of the method, the philosophy of the method and effective factors, the structure of earthquake codes, a complete review of Iran's earthquake code and comparison of codes. Different types of earthquakes
9-10	Dynamic analysis of structures against earthquakes (one and several degrees of freedom): dynamic analysis of structures, modeling and degrees of freedom of free vibration of structures, resonance phenomenon and damping effect, Duhamel integral, free vibration modes, principles of modal analysis method in earthquakes
11-12-13	Quasi-dynamic (spectral) method of analyzing structures against earthquakes, displacement and acceleration and spectral quasi-velocity, response spectra and design, number of effective modes in the analysis, reference to non-linear spectra
14-15-16	Structural resistant systems for horizontal earthquake load and their behavior, bending and braced frames, shear wall, composite systems

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (5%), Project (15%), Midterm (30%), Final (50%)

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SYLLABI ON WEB PAGES

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LOADING OF STRUCTURES

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Loading of Structures, S7

Number of credits: 2

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

Earthquake Engineering

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
2 h	-	-	-

COURSE OBJECTIVES

The main goal of this lesson is to familiarize students with how to load various structures.

REQUIRED STUDENT RESOURCES

Textbooks and References:

1- Management and Planning Organization, Loading Regulations of Road and Railway Bridges, Publication 139.
2- Management and Planning Organization, Seismic Loading Regulations of Road and Railway Bridges, Publication 463.
3- American Society of Civil Engineers, Minimum Design Loads for Buildings And Other Structures: SEI/ASCE 7-05, ASCE, 2005.
4- Wind Loading of Structures, Taylor & Francis, 2007

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic	Reading /Assignment
1	Introduction	-
2-4	Overview of the loads on the structures, static and quasi-static method to determine the computational loads	-
5-7	Permanent loads and operating overheads, reduction of overheads, loads during execution	-
8--9	Atmospheric loads (wind and snow), theoretical bases and calculation methods	-
10-11	Accidental loads (earthquake, collision of vehicles), load distribution between resistant components	-
12-13	Examining loading issues in special structures (sources, platforms, silos)	-
14-16	Loading on road and railway bridges	-

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (30%), Midterm (0%), Final (60%)

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SYLLABI ON WEB PAGES

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SURVEYING OF RAILWAY PATH AND OPERATION

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Surveying of Railway Path and Operation, S6

Number of credits: 2

COURSE PREREQUISITES:

Surveying Theory & Practice

COURSE CO-REQUISITES:

Rail route planning and design

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
2 h	-	1h	-

COURSE OBJECTIVES

Familiarity with the railway Surveying

REQUIRED STUDENT RESOURCES

Textbooks and References:

1-Soleimani, Surveying the route and arcs in road construction, Azarakhsh, 2011.
2-Dianatkhah, Engineering Surveying, Isfahan University of Technology, 2014.
3-C. D. Ghilani and P. R. Wolf, Elementary surveying. Prentice hall, 2010.
4-C. D. Ghilani & P. R. Wolf, Elementary Surveying, 2010.

Web links: -

Computer Software:-

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	A more comprehensive study of determining the location of points through triangulation
2	A more comprehensive study of determining the location of points through triangulation
3	Getting to know the different stages of surveying in railway projects
4	Geometric specifications
5	Types of arcs and calculations related to them
6	Method of nailing the track
7	Underground surveying: point transfer, extension transfer, profile control in a tunnel
8	Underground surveying: point transfer, extension transfer, profile control in a tunnel
9	Familiarity with the principles of photogrammetry
10	Preparation of a map to a 300-meter band and limited to a scale of 1/2000 and establishing the route specifications
11	Preparation of a map to a 300-meter band and limited to a scale of 1/2000 and establishing the route specifications
12	horizontal and vertical arches
13	horizontal and vertical arches
14	Preparation of various longitudinal and transverse profiles and calculation of the level and volume of earthworks of the route
15	Preparation of various longitudinal and transverse profiles and calculation of the level and volume of earthworks of the route
16	Map leveling and gridding

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (30%), Midterm (30%), Final (30%)

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SYLLABI ON WEB PAGES

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RAILWAY COMMUNICATION AND SIGNALING SYSTEMS

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Railway Communication and Signaling Systems,S4
Number of credits: 3

COURSE PREREQUISITES:

Basic of Electrical Engineering in Railway

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
3 h	-	-	1 h

COURSE OBJECTIVES

Students are expected to become familiar with the following topics:

- ✓ Different types of railway signals
- ✓ Interlocking
- ✓ Fixed block signaling systems
- ✓ Relays
- ✓ Train detection systems

REQUIRED STUDENT RESOURCES

References:

1. J. Pachl, Railway Control and Operation, 4th Edition, VTD Rail Publishing, 2018.
2. O. S. Nock, Railway Signaling, Institute of Railway Signal Engineering, A & C Black, 1997.
3. B. Ning, Advanced Train Control Systems, WIT Press, 2010.

Web links: -

Computer Software: -

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic	Reading /Assignment
1	Introduction of signaling and communication systems in railway	-
2	History and developments of railway signals	-
3	Basics of fixed block signaling system in railways	-
4	Introduction of different signal types in railway and their application (semaphore, light signals, …)	-
5	Drawing the single line diagram of different fixed block signaling (2-aspect, 3-aspect, 4-aspect and 5-aspect blocks)	-
6	Methods of calculating Service Braking Distance in railway lines, calculating average gradient of line	-
7	Example of calculating the Service Braking Distance for a real line and its considerations	-
8	Headway and capacity definitions and their affecting parameters	-
9	Calculation of headway and capacity for different fixed block signaling	-
10	Examples of designing signaling systems for some railway lines	
11	Introduction of fail-safe, redundancy, and fault tolerance concepts	-
12	Train detection systems (track circuits, axle-counter, …)	-
13	All types of track circuits (DC, AC, impulse, and audio frequency): Structure, working principles, and design considerations	-
14	• Structure and working principles of point machines • Introduction to relays (types, structures, and working principles) and relay circuits	-
15	Introduction to interlocking (history, basics, and applications)	-
16	All types of Railway Traffic Control Centers	-

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (10%), Midterm (40%), Final (40%)

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SYLLABI ON WEB PAGES

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STRATEGIC MANAGEMENT AND ECONOMICS IN RAILWAY

BASIC INFORMATION

Place in Curriculum, title and semester: Core, Strategic management and economics in railway, S8

Number of credits: 2

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
2 h	-	-	-

COURSE OBJECTIVES

In this course, the students are expected to become familiar with theories related to economics and engineering economics and its application in railways.

REQUIRED STUDENT RESOURCES

References:

1- AREMA, Chapter 16, Economics of railway engineering and operations

2- S. Cole, Applied Transport Economics: Policy Management and Decision Making. Kogan Page Publishers, 2005.

3- W. G. Sullivan, E. M. Wicks and C. P. Koelling, Engineering Economy, Prentice Hall, 14th Edition, 2008.

Web links: -

Computer Software: COMFAR

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1-5	An introduction to the basics of economics, including the concepts of engineering economics, principles of engineering economics, profit calculation methods, economic lives, depreciation and depreciation capital allocation, cash flow circulation and taxes and annual balance sheets, mathematics of engineering economics, types of discount factors, definition of options, principles of comparison option, discounting techniques, inflation and calculation formulas, substitution analysis and break-even point, decision-making basics, risk analysis, uncertainties, possible optimization, financial analysis and financial allocation, basics of multi-criteria evaluation, basics of micro and macroeconomics
5-10	Economy in rail transportation including: understanding the rail transportation market in Iran and world, rail economy policies, demand forecasting methods, financing policies of the rail sector, private sector role in the rail market, legislation and its role in the rail market, basics of economic calculations in the rail industry and asset management in rail transportation
11-16	Studies on technical and economic evaluation of railway route selection including: identification of Traffic generation and attraction region, methods of studying and predicting the regional traffic situation, traffic demand, investigating the potential of different transportation systems in attracting traffic in the region, the role of building a new routes in the development of the region, and interaction effects of transportation and, methods of calculating the transport capacity of different scenarios, identifying the effective factors in the construction of the route and determining the share of each factor in the cost and income of the new route, investigation of the necessary investment in the construction of the infrastructure and the role of geometric characteristics in cost of the project, maintenance and operation costs of the project, stations and their role in the technical and economic validation of the route, facilities and infrastructure equipment according to the route classification, facilities and equipment of the fleet according to the required capacity on the route

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (15%), Project (15%), Midterm (20%), Final (50%)

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SYLLABI ON WEB PAGES

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URBAN TRANSPORTATION PLANNING

BASIC INFORMATION

Place in Curriculum, title and semester: Optional, Urban Transportation Planning

Number of credits: 2

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
2 h	-	-	-

COURSE OBJECTIVES

Familiarity with urban transportation planning and demand models

REQUIRED STUDENT RESOURCES

References:

1- W. Mallett, Metropolitan transportation planning. DIANE Publishing, 2010.

2- P. K. Sarkar, V. Maitri, and G. Joshi, Transportation planning: Principles, practices and policies. PHI Learning Pvt. Ltd., 2017.

Web links: -

Computer Software: COMFAR

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	Traffic engineering
2	Capacity definition, traffic volume
3	Travel time studies Urban transportation planning, main objectives, criteria
4	Basic concepts in transportation engineering
5	The relationship between land use and transportation
6	Forecasting models in transportation
7	Studies and types of demand models
8	Travel production and attraction models
9	Travel distribution models
10	Device selection models
11	Traffic allocation models
12	Design and management of parking lots and their location
13	Public transportation
14	Various economic, social and environmental effects of transportation
15-16	Demand management policies in urban transportation

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (10%), Midterm (30%), Final (50%)

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SYLLABI ON WEB PAGES

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PROJECT MANAGEMENT IN RAILWAY CONSTRUCTION

BASIC INFORMATION

Place in Curriculum, title and semester: Optional, Project management in railway construction

Number of credits: 2

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
2 h	-	-	-

COURSE OBJECTIVES

Familiarity with the science of project management and its application in railways

REQUIRED STUDENT RESOURCES

References:

1- H. Kerzner, Project management: a systems approach to planning, scheduling, and controlling. John Wiley & Sons, 2017.

2- Rose, Kenneth H, A Guide to the Project Management Body of Knowledge (PMBOK® Guide)—Fifth Edition, Project management journal 44.3 (2013): e1-e1.

Web links: -

Computer Software: COMFAR

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	An introduction to project management
2	Project management methodology and standards
3	Life cycle of a project
4	Project management processes
5	Integrity management
6	Time management
7	Cost management
8	Communication management
9	Quality management
10	Risk management
11	Human resource management
12-13	Procurement management
14-16	Project management software

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (10%), Midterm (30%), Final (50%)

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SYLLABI ON WEB PAGES

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RAILWAY BRIDGES PROJECT

BASIC INFORMATION

Place in Curriculum, title and semester: Optional, Railway Bridges Project

Number of credits: 1

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
-	-	1h	-

COURSE OBJECTIVES

Practical application of railway bridge course 1 and 2 in the complete design of railway bridges

REQUIRED STUDENT RESOURCES

References:

1- F. Chen and L. Duan, Bridge engineering handbook: construction and maintenance. CRC press, 2014.

2- R. M. Barker and J. A. Puckett, “Design of Highway Bridges: An LRFD Approach”, 2nd Eidtion, Wiley, 2006.

Web links: -

Computer Software: COMFAR

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1-16	In this course, each student must receive a project related to concrete and steel bridges from the relevant professor. Design the bridge structure by knowing the length of the bridge span, the number of bridge spans, the width of the bridge, the distance between the longitudinal girders and the specifications of the materials used.

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (15%), Project (25%), Midterm (-%), Final Project (60%)

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SYLLABI ON WEB PAGES

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ENGLISH FOR RAILWAY ENGINEERS

BASIC INFORMATION

Place in Curriculum, title and semester: Optional, English for railway engineer

Number of credits: 2

COURSE PREREQUISITES:

-

COURSE CO-REQUISITES:

-

TEACHERS:

Person in charge: Department of Railway Engineering
Office location:
Phone Number:
Email Address:

WEEKLY HOURS

Theory	Problem Solving	Laboratory	Guided learning
2 h	-	-	-

COURSE OBJECTIVES

The purpose of this course is to acquaint students with specialized texts in the field of railway engineering.

REQUIRED STUDENT RESOURCES

References:

1- 1- M. R. Kay Manesh and P. Jafari Haqitpour, specialized language of railway engineering, Novavar Publications, 1400.

2- 2- M. Mirtbatabaei, Z. Islamic Rasakh, h. Moqbli, English for railway engineering students, Samt Publications, 2017.

3- J. A. Zakari Sardroudi, Descriptive Glossary of Line Engineering and Rail-Railway and Metro Structures, Isfahan University Press, 2018.

Web links: -

Computer Software: COMFAR

COURSE SCHEDULE/OUTLINE/CALENDAR OF EVENTS

Week 16	Topic
1	The Emergence of Transportation
2	Architects and Engineers
3	Track
4	Pre-Stressed Concrete Sleepers (Monoblock)
5	Improving Passenger Safety at Platforms
6	Signaling and Train Control
7	Creep
8	Strategies for Maximizing Rail Life
9	Solid Lubricant to the London Underground Limited
10	Earthworks, Drainage and Fencing
11	Bridges and Structures
12-13	Tunnels and Tunneling
14-16	Electrification

EVALUATION PROCEDURES AND GRADING CRITERIA

HWs (10%), Project (10%), Midterm (30%), Final (50%)

ATTENDANCE STATEMENT

The course instructor must clearly inform students on the first day of class and in writing in the syllabus of their (1) policy regarding class absence and (2) policy, if any, for making up missed assignments. If class attendance is a component of the course grade, the course instructor must clearly communicate this to the class in writing in the syllabus.

STUDENTS WITH DISABILITIES ACT FOR STUDENTS WITH SPECIAL NEEDS STATEMENT

The following statement must appear on all syllabi: "Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor and contact the Disability Services Office as soon as possible."

APPROVED ACADEMIC HONESTY STATEMENT

The following statement must appear on all syllabi: "The academic community is operated on the basis of honesty, integrity, and fair play. It applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records.

SYLLABI ON WEB PAGES

Syllabi presented on web pages shall contain the date of last update.