Railway Track Structures - BMEEOUVMU64

I. Subject Specification

1. Basic Data

1.1 Title

Railway Track Structures

1.2 Code

BMEEOUVMU64

1.3 Type

Module with associated contact hours

1.4 Contact hours

Type	Hours/week / (days)
Lecture	4

1.5 Evaluation

Exam

1.6 Credits

5

1.7 Coordinator

name	Dr. Szabolcs FISCHER, Ph.D.
academic rank	Associate professor
email	fischersz@sze.hu

1.8 Department

Department of Highway and Railway Engineering

1.9 Website

https://epito.bme.hu/BMEEOUVMU64
https://fiek2.mywire.org/course/view.php?id=3500

1.10 Language of instruction

english

1.11 Curriculum requirements

Optional in the Infrastructure Engineering (MSc) programme

1.12 Prerequisites

1.13 Effective date

1 September 2022

2. Objectives and learning outcomes

2.1 Objectives

The aim of the course is to acquaint students with the latest developed railway track structures in the case of railways, subways and tramways. The students can listen case studies that are related to the most modern superstructures.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

1. knows the elements and mechanisms of ballasted and ballastless tracks, as well as jointed and CWR tracks,
2. knows the railway track superstructure types and their properties, characteristics,
3. knows the construction technologies of railway tracks (superstructures),
4. knows the important calculation methods to determine mechanical stresses and deformations in railway permanent ways' elements and layers,
5. knows the types of railway bridges and the related railway track structures, as well as he/she is familiar with the interaction between railway track and railway bridge,
6. knows the special set-up of transition zones,
7. knows the multi-level shear box test and he/she is familiar with the railway granular materials and geosynthetic-reinforced railway granular materials (laboratory and field tests, as well as discrete element modelling),
8. knows the modern tramway and subway superstructures,
9. knows the superstructures of special railway tracks (turnouts, crossings, grade crossings, etc.), knows special case studies, e.g. crumbling examination of railway crushed stones by individual laboratory method and extra energy consumption due to speed restrictions, glued insulated rail joints with glass fibre-reinforced fishplates.

B. Skills

1. is able to form an opinion on construction technologies of railway tracks (superstructures),
2. is able to form an opinion on normal and special railway superstructure types,
3. is be able to form an opinion on superstructure dimensioning procedures (methods),
4. is able to determine the maximum inner forces in complex cases using the Zimmermann (and Zimmermann-Eisenmann) method,
5. is able to determine the theoretical loads of the multilayer railway track structure,
6. is able to compile rail gap tables,
7. is able to perform track stability testing in simpler cases,
8. is able to form an opinion on superstructure types of special railway tracks (turnouts, crossings, grade crossings, etc.),
9. is able to form an opinion on case studies that are related to railway track structures.

C. Attitudes

1. cooperates with the instructor in the preparation of partial performance assessments,
2. strives for an accurate and error-free solution,
3. strives for precise, professional wording in his/her oral and written statements,
4. in his/her written performance appraisals, strive for orderly, engineering-quality and strives to produce orderly documentation of the quality and appearance expected at the engineering level during his/her written performance evaluations.

D. Autonomy and Responsibility

1. prepare responsibly for the successful completion of tasks,
2. carry out the independent sub-tasks, independently and to the best of his/her ability,
3. openly accepts substantiated critical remarks.

2.3 Methods

Lectures with presentations, independently prepared home works, communication in writing and orally: performance appraisal, exam, and active participation in contact classes.

2.4 Course outline

Week	**Topics of lectures and/or exercise classes**
1.	General studies 1. Introduction into railway permanent ways I. (Set-up of railway vehicles; Railway track and vehicle; Loading gauge and structural gauge; Cross-sectional dimensions of railway permanent ways; Railway traction force and resistances; Geometrical design of railway tracks in general)
2.	General studies 2. Introduction into railway permanent ways II. (Railway track structures: ballasted and ballastless tracks; Elements of railway tracks I.)
3.	General studies 3. Introduction into railway permanent ways III. (Elements of railway tracks II.)
4.	General studies 4. Introduction into railway permanent ways IV. (Tracks with normal 'gapped' (fishplated) rail joints as well as CWR tracks; Set-up of substructure and supplementary layers)
5.	General studies 5. Reserve week to supplement the missing information and lessons
6.	Construction of ballasted railway tracks (construction technologies)
7.	Calculation of mechanical stresses and deformations in railway permanent ways' elements and layers
8.	Interaction between railway track and railway bridge. Set-up of transition zones.

9.	Laboratory tests with granular materials as well as field tests with geogrids
10.	Modern tramway superstructures
11.	Modern subway superstructures
12.	Crumbling examination of railway crushed stones by individual laboratory method
13.	Investigation of glued insulated rail joints
14.	Extra energy consumption due to speed restrictions

The above programme is tentative and subject to changes due to calendar variations and other reasons specific to the actual semester. Consult the effective detailed course schedule of the course on the subject website.

2.5 Study materials

a) Textbooks:

1. Lichtberger, B.: Track compendium, Eurailpress Tetzlaff-Hestra GmbH & Co. Publ., Hamburg, 2005
2. Esveld, C.: Modern railway tracks, MRT Production, Zaltbommel, 2014
3. Mundrey, JS: Railway Track Engineering, 5th Edition, Mc Graw Hill India, 2017

b) Online materials:

1. Presentations: Fischer, S.: Railway track structures, BUTE, 2022
2. Electronic lecture notes: Fischer, S., Eller, B., Kada, Z., Németh, A.: Railway engineering, Universitas-Győr Nonprofit Kft., Győr, 2015

2.6 Other information

1. Attendance to lectures is compulsory. The signature and credits from the subject will be refused to students missing more than 4 (i.e. attending less 9 classes).
2. Students are evaluated based on their actual individual performance. Students are required to show evidence of their own knowledge and skills. Submitting a work of others, obtaining or giving unauthorized help (e.g. during an exam or test) cheating and plagiarism in any form is unacceptable. Whoever violate the respective Regulations of the University will be given a failing grade (1), without the possibility of retake and repeat, and will be reported to the Dean’s Office.

2.7 Consultation

According to the information on the Dept.’s website.

This Subject Datasheet is valid for:

2023/2024 semester I

II. Subject requirements

Assessment and evaluation of the learning outcomes

3.1 General rules

The assessment of the learning outcomes specified in clause 2.2. above and the evaluation of student performance occurs via tests, homework assignments and class work.

3.2 Assessment methods

Evaluation form	Abbreviation	Assessed learning outcomes
1. control test	ED1	A.1-A.5; B.1-B.7; C.3-C.4; D.1
2. control test	ED2	A.6-A.9; B.8-B.9; C.3-C.4; D.1
1. homework	HF1	A.1-A.4; B.3-B.5; C.1-C.2; D.2-D.3
2. homework	HF2	A.1-A.9; B.1-B.9; C.1-C.2; D.2-D.3
attendance and activity	A	A.1-A.9; B.1-B.9; C.1-C.2; D.1-D.3
written examination	V	A.1-A.9; B.1-B.9; C.3-C.4; D.1

The dates of deadlines of assignments/homework can be found in the detailed course schedule on the subject's website.

3.3 Evaluation system

Abbreviation	Score
ED1	10%
ED2	10%
HF1	10%
HF2	10%
A	
Total achievable during the semester	40%
V	60%
Sum	**100%**

ED1, ED2, HF1, HF2 are scoreless if they do not reach 50% of the available score.
Exam score less than 50% of the available score per exam question separately and together it results in a scoreless exam.

3.4 Requirements and validity of signature

The condition for obtaining the signature is that the score (based on 3.3) that can be obtained during the semester period (excluding exam period) according to achieve at least 50% of the points: both for each individual performance appraisal and for the cumulative in terms of score. In addition, attendance at 70% of the lectures is compulsory.

3.5 Grading system

Grade	Points (P)
excellent (5)	87.5%<=P
good (4)	75%<=P<87.5%
satisfactory (3)	62.5%<=P<75%
passed (2)	50%<=P<62.5%
failed (1)	P<50%

The grade of those who meet the conditions of attendance is determined according to the following criteria:
Control tests (ED1 and ED2) and homeworks (HF1 and HF2) are successful if the student has individually

reached the 50% of the total score.
Completion of active participation is not obligatory, however, the semester grade is specified in Section 3.3. according to point weighted.
A semester is successful if the student has achieved at least the 50% of all the scores available in the semester, i.e. (ED1 + ED2 + HF1 + HF2 + A) × 50%.
In the written exam, several questions must be answered, each exam question must be answered separately and they have to reach the min. 50% of their score.

3.6 Retake and repeat

1. Homework – in addition to paying the fee specified in the regulations – is delayed in the “Detailed semester schedule”.
2. Due to its nature, active participation cannot be replaced or improved.
3. The control tests (ED1 and ED2) can be replaced or improved for the first time (the date is according to the "Detailed semester schedule") free of charge. In case of correction (improvement), the new result overwrites the previous result in all cases.
4. If the student is not able to obtain a grade other than insufficient (scoreless) even with the replacement according to point 3), so – in addition to paying the fee specified in the regulations – a second, repeated attempt can do to improve the first replacement of one of the failed control test in the 'replacement week'.

3.7 Estimated workload

Activity	**Hours/semester**
contact hours	14×4=56
preparation for the tests	2×12=24
preparation of homeworks	2×15=30
preparation for the examination	40
Sum	**5×30=150**

3.8 Effective date

1 September 2022

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2023/2024 semester I