

I. Tantárgyleírás**1. Alapadatok***1.1 Tantárgy neve***RAILWAY TRACK STRUCTURES AND DIAGNOSTICS***1.2 Azonosító (tantárgykód)***BMEEOUVMSFIN04-00***1.3 Tantárgy jellege*

Kontaktórás tanegység

1.4 Óraszámok

Típus	Óraszám / (nap)
Előadás (elmélet)	3

1.5 Tanulmányi teljesítményértékelés (minőségi értékelés) típusa

Vizsga

1.6 Kreditszám

4

1.7 Tárgyfelelős

név	Dr. Fischer Szabolcs
beosztás	Egyetemi docens
email	fischersz@sze.hu

1.8 Tantárgyat gondozó oktatási szervezeti egység

Út és Vasútépítési Tanszék

1.9 A tantárgy weblapjaepito.bme.hu<https://edu.epito.bme.hu/course/view.php?id=5200>*1.10 Az oktatás nyelve*

magyar

1.11 Tantárgy típusa

Kötelező az Infrastruktúra-építőmérnök (MSc) szak Út- és vasútmérnöki specializációján

*1.12 Előkövetelmények**1.13 Tantárgyleírás érvényessége*

2025. szeptember 1.

2. Céltűzések és tanulási eredmények

2.1 Céltűzések

The aim of the course is to familiarize the students with the latest developments in track structures and some of their special stress and stability analysis methods. After completing the course, they will be able to determine the behavior of different types of superstructures (conventional fishplated jointed, as well as CWR), the interaction between superstructure and structures. Case studies of the (most) modern superstructures will also be presented. The second aim of the course is to learn about diagnostic tools, methods and applications of railway track (superstructure and substructure) and the operation of measurement systems. An overview of degradation models and possible life cycle analysis processes. Processing of diagnostic results, certification methods, understanding of the requirements of some relevant standards.

2.2 Tanulási eredmények

A tantárgy sikeres teljesítése utána a hallgató

A. Tudás

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 modern tramway and subway superstructures, 8. knows the diagnostic tools of railway track structures and the reliability of the data they provide, 9. knows the concept of life cycle analysis, 10. knows the deterioration models of track structures and intervention levels (limits), 11. knows the methods, significance, application areas, and tools of railway track diagnostics, 12. has detailed knowledge of handheld tools and measurement trains used for the geometric measurement of railway superstructure and the data they provide, 13. understands the processing of railway diagnostic results, classification methods, and limits, as well as relevant regulations and standards.

B. Képesség

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 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 case studies that are related to railway track structures, 9. can select the appropriate diagnostic tool for identifying a specific defect, 10. is capable of evaluating a raw dataset from a railway diagnostic measurement, 11. is able to infer the track condition based on railway diagnostic measurements, 12. understands what data is required for the operation of track management systems, 13. is capable of using different diagnostic tools for measuring railway track conditions and analyzing the data, 14. is able to interpret and utilize railway diagnostic results for track quality assessment and the development of maintenance strategies, 15. applies regulations related to railway track diagnostics in practice.

C. Attitűd

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. Önállóság és felelősség

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 Oktatási módszertan

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

2.4 Részletes tárgyprogram

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. Construction of ballasted railway tracks (construction technologies). 6. Calculation of mechanical stresses and deformations in railway permanent ways' elements and layers. Interaction between railway track and railway bridge. Set-up of transition zones. 7. Tramways, subways. 8. The basics of diagnostics. Lifetime of railway permanent ways. Maintenance of railway tracks. Supervision of railway tracks. 9. Deterioration process of railway tracks. Railway track diagnostics system. Measurement possibilities of the clearance gauge. Measurement possibilities of the railway track geometry. 10. Geometrical evaluation of the railway track. 11. Diagnostics of the railway earthworks (substructures). 12. Diagnostics of railway rails. 13. Diagnostics of other superstructural elements in railway tracks (sleepers, rail fasteners, fishplates, ballast). 14. Reserve week.

A félév közbeni munkaszüneti napok miatt a program csak tájékoztató jellegű, a pontos időpontokat a tárgy honlapján elérhető "Részletes féléves ütemterv" tartalmazza.

2.5 Tanulástámogató anyagok

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 and diagnostics, BUTE, 2025 2. Electronic lecture notes Fischer, S., Eller, B., Kada, Z., Németh, A.: Railway engineering, Universitas-Győr Nonprofit Kft., Győr, 2015

2.6 Egyéb tudnivalók

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 Konzultációs lehetőségek

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

Jelen TAD az alábbi félévre érvényes:

II. Tárgykövetelmények**3. A tanulmányi teljesítmény ellenőrzése és értékelése***3.1 Általános szabályok*

The assessment of the learning outcomes specified in clause 2.2. above and the evaluation of student performance occurs via examination.

3.2 Teljesítményértékelési módszerek

Assessment Name (Type)	Code	Assessed Learning Outcomes
Exam	E	A.1-A.13; B.1-B.15; C.1-C.4; D.1-D.3

A szorgalmi időszakban tartott értékelések pontos idejét, a házi feladatok ki- és beadási határidejét a "Részletes féléves ütemterv" tartalmazza, mely elérhető a tárgy honlapján.

3.3 Teljesítményértékelések részaránya a minősítésben

Code	Weight
E	100%
Total	100%

3.4 Az aláírás megszerzésének feltétele, az aláírás érvényessége

Attendance at 70% of the lectures is compulsory.

3.5 Érdemjegy megállapítása

Grade	Score (P)
excellent (5)	$87 \leq P$
good (4)	$75 \leq P < 87\%$
satisfactory (3)	$62 \leq P < 75\%$
pass (2)	$50 \leq P < 62\%$
fail (1)	$P < 50\%$

3.6 Javítás és pótlás

Exams can be repeated in accordance with the Study and Examination Regulations.

3.7 A tantárgy elvégzéséhez szükséges tanulmányi munka

Activity	Hours/Semester
contact hours	$14 \times 3 = 42$
continuous preparation for the lectures	$14 \times 2 = 28$
preparation for the examination	50

3.8 A tárgykövetelmények érvényessége

2025. szeptember 1.

Jelen TAD az alábbi félévre érvényes: