Highway and Railway Structures - BMEEOUVAI41

I. Subject Specification

1. Basic Data

1.1 Title

Highway and Railway Structures

1.2 Code

BMEEOUVAI41

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. Tóth Csaba
academic rank	Associate professor
email	toth.csaba@emk.bme.hu

1.8 Department

Department of Highway and Railway Engineering

1.9 Website

https://epito.bme.hu/BMEEOUVAI41
https://fiek2.mywire.org/course/view.php?id=3585

1.10 Language of instruction

english

1.11 Curriculum requirements

Compulsory in the Specialization in Infrastructure Engineering (BSc) programme

1.12 Prerequisites

1.13 Effective date

1 September 2022

2. Objectives and learning outcomes

2.1 Objectives

The aim of the subject in the field of road structures is to acquire the knowledge necessary for the planning and dimensioning of asphalt and concrete pavement structures.
On the topic of railway track structures: the function, design, load transfer and the most important technical solutions of certain elements of railway track structures.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

1. knows the construction order and types of road structures,
2. knows the requirements imposed on road structures, the environmental factors affecting durability factors,
3. knows the materials of the base and covering layers that can be designed into the track structure,
4. knows the concept of the unit axis and the planning flow determination steps,
5. knows the types of track structures that can be designed,
6. knows the design principles of concrete pavements and the construction technology limitations to be taken into account,
7. knows the lowtraffic designable pavement structures of roads,
8. knows the most important cause-and-effect relationships in the process of failure of road structures,
9. knows the bending-based method of pavement reinforcement,
10. knows the comparative principle method of pavement reinforcement,
11. knows the most important recycling technologies,
12. knows the main rules for the placement of utilities in and under the track structure,
13. knows the practice of size and quantity determination,
14. knowledge of the structure of the railway track;
15. rails, rail-joints, rail welds, bottoms, bedding, knowledge of the technical characteristics and application conditions of substructures, road crossings, additional structures;
16. knowledge of the theoretical definition of stresses arising in the track structure;
17. theoretical knowledge of the internal forces of the CWR track.

B. Skills

1. able to determine the damaging effect of heavy vehicle traffic,
2. able to design the asphalt pavement road structure that matches the design conditions,
3. able to design the concrete pavement that matches the design conditions,
4. able to design low-traffic for designing the track structure of roads with stone and artificial stone pavement,
5. is able to make a connection between the main defects that occur on the road surface and the track structure layer and the causes of the defects to find,
6. capable of determining the necessary reinforcement layer thickness of an existing road structure using a bendingbased or comparative method,
7. capable of recycling technologies during the planning of the renovation of existing road structures for

application,
8. is able to take into account professional aspects and requirements during the planning of the road structure,
9. is able to calculate the size and quantity of the layers of the planned road structure, specified item order
10. is able to select a track structure element that meets the needs of the given railway traffic,
11. able to select the complete railway track structure layer order,
12. able to theoretically determine the stresses arising in railway track structural elements,
13. able to determine the stresses resulting from temperature changes in the railway track structure.

C. Attitudes

1. he/she strives for accurate and error-free task solutions,
2. he/she strives for neat, professional wording in his oral and written expressions,
3. he/she strives for the orderly quality expected at the engineering level and in his written performance evaluations.

D. Autonomy and Responsibility

1. independently and to the best of his/her ability, completes the partial performance evaluations issued during the individual performance evaluations,
2. accepts well-founded critical comments with an open mind,
3. he uses the systemic approach in his thinking.

2.3 Methods

Lectures with presentation, written and oral communication (during performance evaluation and exam).

2.4 Course outline

Week	**Topics of lectures and/or exercise classes**
1.	Basic concepts of road construction. Road structures, types. The engineering structure of the railway track. Rails I.
2.	Requirements of the road structures. Rails II.
3.	Roadway structure materials. Planable basic and asphalt layers. Rail fastenings I.
4.	Traffic loads. Vehicle types, the concept of the unit axle. Rail fastenings II.
5.	Dimensioning of newly built roadway structures. Type track structures. Rail-joints, Rail welds.
6.	Design of concrete pavements. Railway sleepers I.
7.	Low traffic track structures of roads. Stone, concrete stone covered track structures. Railway sleepers II.
8.	Road structure diagnostics, the process of damage.

	Errors and causes of errors. The railway ballast bed.
9.	Reinforcement of existing road structures sizing based on bending. Substructure protective layers.
10.	Sizing reinforcements, the comparative method. Longitudinal forces in the track.
11.	Other technologies for the renovation of track structures. Highway crossings.
12.	Placement of utilities in and under the track structure. Additional superstructural elements of the railway tracks.
13.	The relationship between waterworks and the track structure. Internal forces of the railway track.
14.	The concept of item order and the most important items are technical contant. Stability of the railway tracks against buckling.

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

1. Lecture notes and presentations uploaded onto the website of the Subject,

2. Dr. Nándor Liegner: Railway Tracks lecture notes and e-book for the courses of Railway Tracks and Pavement Structures of Railway Tracks, Budapest, 2014.

3. Dr. Jenő Megyeri: Railway Engineering, Budapest, 1991.

2.6 Other information

Participation in contact classes is 70% mandatory. A student who misses 6 or more classes cannot obtain credit for the course.

2.7 Consultation

As stated on the website of the Department.

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 evaluation of the learning outcomes stated in point 2.2. are carried out in written tests and at the end-of-semester exam.

3.2 Assessment methods

Evaluation form	Abbreviation	Assessed learning outcomes
Written test 1 in the performance period	ZH1	A.1-A.5, A.14-A.15; B.1-B.2, B.10; C.1-C.3; D.1-D.3
Written test 2 in the performance period	ZH2	A.6-A.8, A.15-A.17; B.3-B.5, B.10-B.11; C.1-C.3; D.1-D.3
Exam in the exam period	V	A.1-A.17; B.1-B.13; C.1-C.3; D.1-D.3

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
ZH1	15%
ZH2	15%
V	70%
Sum	**100%**

Within ZH1 and ZH2, railway and highway parts will be written, and they will be graded separately. If both results pass then the grade is the mathematical average of the two parts. If one or both of the railway and/or highway parts fail(s) then the grade of the ZH is fail. If either or both of the parts receive less than 50% of the total score, that part of test fails.
If the examinee receives at least 50% of the total score, the exam passes. If less than 50% is achieved then the exam is failed.

3.4 Requirements and validity of signature

The condition for obtaining the signature is that 3.3. point, the individual performance evaluations are successful fulfillment. In addition, attendance at 70% of lectures and exercises is mandatory.

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%

3.6 Retake and repeat

1. The two summative academic performance evaluations during the performance period – for the first time – can be replaced or repaired free of charge. In the case of a correction, the student from the previous result and the new result is considered more favorable for him/her.
2. If the student does not get a grade other than insufficient even with the replacement according to point 1). to obtain, in addition to paying the fee specified in the regulations, for the second time, combined in the form of a repeated attempt to repair only one unsuccessful first restoration. Both ZH in this form cannot be replaced. The second replacement option can only be used if the person to be replaced is on ZH the Student appeared on the corresponding first replacement.

3.7 Estimated workload

Activity	**Hours/semester**
participation in contact classes	28×2=56
continuous preparation for lectures	26×1=26
preparation for performance evaluations mid-term written exams	2×10=20
preparation for end-of-semester exam	48
Sum	**150**

3.8 Effective date

1 September 2022

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2023/2024 semester I