Bridges and Infrastructures - BMEEOHSAS43 - 2024/25/2

I. Tantárgyleírás

1. Alapadatok

1.1 Tantárgy neve

Bridges and Infrastructures

1.2 Azonosító (tantárgykód)

BMEEOHSAS43

1.3 Tantárgy jellege

Kontaktórás tanegység

1.4 Óraszámok

Típus	Óraszám / (nap)
Előadás (elmélet)	2

1.5 Tanulmányi teljesítményértékelés (minőségi értékelés) típusa

Vizsga

1.6 Kreditszám

3

1.7 Tárgyfelelős

név	Dr. Jáger Bence
beosztás	Adjunktus
email	jager.bence@emk.bme.hu

1.8 Tantárgyat gondozó oktatási szervezeti egység

Hidak és Szerkezetek Tanszék

1.9 A tantárgy weblapja

https://epito.bme.hu/BMEEOHSAS43
https://edu.epito.bme.hu/course/view.php?id=445

1.10 Az oktatás nyelve

magyar és angol

1.11 Tantárgy típusa

Kötelező az építőmérnöki (BSc) szak Szerkezet-építőmérnöki ágazatán

1.12 Előkövetelmények

Strong prerequisites:

- Steel Structures (BMEEOHSAT42)
- Reinforced Concrete Structures (BMEEOHSAT43)

1.13 Tantárgyleírás érvényessége

2022. szeptember 1.

2. Célkitűzések és tanulási eredmények

2.1 Célkitűzések

The primary aim of the course is to provide the students with basic knowledge on the functional and structural design principles as well as the structural behaviour of bridges and key objects of the infrastructure. During the semester the following topics are discussed: historical development, basic terms and classification of bridges; superstructure systems, typical superstructures of steel, steel and concrete composite as well as concrete bridges; composite action between main girders; basis of bridge design, traffic load models and their application rules for highway and railway bridges; substructures of bridges (abutments and piers), bridge equipment; conceptual design of bridges (fitting of bridges into environment, bridge aesthetics); civil engineering work of traffic infrastructure, water-supply and waste-water systems and hydraulic engineering

2.2 Tanulási eredmények

A tantárgy sikeres teljesítése utána a hallgató

A. Tudás

1. knows the historical development, the structural systems and the structural behaviour of bridges,
2. knows the material-dependent superstructure systems, their mayor parts and behaviour,
3. knows the particularities of moving loads, the principles of critical load positioning, the traffic load models of bridges and their application rules,
4. knows the typical substructure types, their parts and behaviour,
5. knows the principles of conceptual bridge design,
6. knows the key objects of traffic infrastructure, water-supply and waste-water systems and hydraulic engineering and the structural aspects of their functioning,

B. Képesség

1. capable of numerical modelling and analysis for grid-type superstructures,
2. capable of defining and positioning of the traffic loads on bridges as well as combining them with other non-traffic actions,
3. able to calculate the extremities of internal forces and stresses at given locations of grid-type superstructures,
4. able to numerically verify the most important structural requirements of bridges,

C. Attitűd

1. cooperates with the lecturer,
2. improves his/her knowledge by consecutive learning activities,
3. open to use numerical software,
4. makes effort to perform exact and error-free calculations,
5. makes effort to understand the structural behavior of bridges and to acquire their design procedures,

D. Önállóság és felelősség

1. capable of modelling grid-type superstructures and performing their preliminary structural analysis without mayor help,
2. individually capable of justifying the exactness of new structural solutions and their basic application,
3. uses systematized thinking approach.

2.3 Oktatási módszertan

Lectures, individually performed homework (modelling and verification tasks), written and oral communication, use of IT tools and techniques.

2.4 Részletes tárgyprogram

Week	**Topics of lectures and/or exercise classes**
1.	Historical development of bridges. Basic terms of bridges. Classification of bridges (function, structural system, material etc.). Typical features of basic structural systems. Relation between structure and flow of forces. Superstructure systems.
2.	Conceptual design of bridges (geotechnical conditions, selection of structural system and material, positioning of supports, selection of cross-section for superstructure, drainage system etc.). Fitting of bridges into environment, bridge aesthetics.
3.	Basis of bridge design (design concept, codes). Overview of actions on bridges (permanent, variable, accidental, seismic). Traffic load models for highway and railway bridges.
4.	Design of a grid-type superstructure
5.	Application rules for traffic load models. Simultaneity of traffic loads with other actions (example).
6.	Superstructures of steel girder bridges (grid systems: longitudinal and transversal beams, solid and truss systems; box girders; deck slabs). Arrangement of structural elements, essence of flow of forces. Composite action of main girders (influence line).
7.	Superstructures of steel and concrete composite girder bridges (grid systems: longitudinal and transversal beams, solid and truss systems; box girders; concrete deck slab; shear connection). Arrangement of structural elements, essence of flow of forces. Composite action of main girders (influence line).
8.	Superstructures of concrete girder bridges (plates, grid systems, precast multiple girder superstructures, box girders). Arrangement of structural elements, essence of flow of forces. Composite action of main girders (influence line).

9.	Substructures of bridges: abutments and piers (structural system, flow of forces).
10.	Bridge equipment (bearings, dilatations, restraining systems, drainage).
11.	Erection systems of steel and concrete bridges.
12.	Civil engineering work in traffic infrastructure, structural systems, flow of forces, typical structures
13.	Civil engineering work in water-supply and waste-water systems, structural systems, flow of forces, typical structures
14.	Civil engineering work in hydraulic engineering. Overview of actions on infrastructural work, basis of structural design

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:

- Hirt, M., Lebet, J-P.: Steel Bridges: Conceptual and Structural Design of Steel and Steel-Concrete Composite Bridges, 1st edition, EPFL Press, Lausanne, 2013 ISBN-13 978-1-4665-7296-6 (recommended)
- Iványi M.: Hídépítés, Műegyetemi Kiadó, Budapest, 1998, ISBN 963 420 478 X, pp. 18-75. (recommended)
- White, K.R., Minor, J., Derucher, K.N.: Bridge Maintenance Inspection and Evaluation, Second edition, Marcel Dekker Inc., New York, 1992 ISBN 0-8247-8609-2, pp. 101-116., pp. 121-124., pp. 131-141. (recommended)
- Pipinato, A. (Ed.): Innovative Bridge Design Handbook - Construction, Rehabilitation and Maintenance, Elsevier, 2016, ISBN: 978-0-12-800058-8 (recommended)

b) Online materials:

- Structural analysis of a grid-type road bridge superstructure (manual to

2.6 Egyéb tudnivalók

1. The homework focuses on the numerical analysis and the most important structural verifications of a grid-type superstructure. The homework shall be completed individually with oral consultation.

2.7 Konzultációs lehetőségek

The instructors are available for consultation during their office hours, as advertised on the department website. Special appointments can be requested via e-mail as follows: homework: jager.bence@emk.bme.hu; otherwise: kovacs.tamas@emk.bme.hu

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 one homework (30 points) during the semester and an oral exam (70 points) at the end of the semester. In total 100 points (100%) are acquirable.

3.2 Teljesítményértékelési módszerek

Evaluation form	Abbreviation	Assessed learning outcomes
Homework, Midterm#1 (midterm evaluation)	HW1	A.2-A.3; B.1-B.4; C.1-C.3, C.4-C.5; D.1
Exam (synthetized evaluation)	E	A.1-A.6; C.1-C.2, C.4-C.5; D.2-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

Abbreviation	Score
HW	30%
exam	70%
Total	**100%**

3.4 Az aláírás megszerzésének feltétele, az aláírás érvényessége

1. Attendance on at least 70% of lectures.
2. Successful submission of homework (min. 50%).

3.5 Érdemjegy megállapítása

Grade	Points (P)
excellent (5)	85<=P
good (4)	75<=P<85%
satisfactory (3)	65<=P<75%
passed (2)	50<=P<65%
failed (1)	P<50%

3.6 Javítás és pótlás

1. The submission deadline for homework is set in the detailed subject requirements.

2. The homework not submitted until the submission deadline may be submitted until the retake deadline set in the detailed subject requirements but is subject to payment of repetition fee. No homework submission is alowed after the retake deadline.
3. If the result of homework remains below 50% (according to clause 3.4 above), also incuding missed submissions, the signature of the subject shall be refused.
4. Retake of an already successful exam is allowed as a subsequent exam in the same exam period. The result of the last exam in the exam period becomes official.

3.7 A tantárgy elvégzéséhez szükséges tanulmányi munka

Total: 3 credits × 30 hours/credits = 90 hours/semester.

Activity	**Hours/semester**
contact hours	14×2=28
homework	5+10+15=40
preparation for the exam	22
Sum	**90**

3.8 A tárgykövetelmények érvényessége

2022. szeptember 1.

Jelen TAD az alábbi félévre érvényes: