SUBJECT DATASHEET

I. SUBJECT SPECIFICATION

1 BASIC DATA

1.1 Title

TIMBER STRUCTURES

1.2 Code

BMEEOHSAS44

1.3 Type

Module with associated contact hours

1.4 Contact hours

type	hours/week
lectures	2

1.5 Evaluation

midterm grade

1.6 Credits

3

1.7 Coordinator

name: Dr. Koris Kálmán
academic rank: assistant professor
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1.8 Department

Department of Structural Engineering (http://epito.bme.hu/hidak-es-szerkezetek-tanszek)

1.9 Website

www.epito.bme.hu/BMEEOHSAS44

1.10 Language of instruction

Hungarian and English

1.11 Curriculum requirements

Compulsory in the Structural engineering programme (BSc)

1.12 Prerequisites

Required previous subjects (need to be completed to register)

Introduction to Strength of Materials (BMEEOTMAT42)

Basis of Design (EOHSAT41)

Subjects from which previous midterm signature are required to register

Construction Materials I. (EOEMAT43)

1.13 Effective date

September 1, 2017.

2 OBJECTIVES AND LEARNING OUTCOMES

2.1 Objectives

The aim of this course is to introduce the materials, types, strengths and design methods of timber structures to the students. Within the scope of the subject the following topics are introduced: material models and strength grades of timber material, design of timber structural members for ULS according to EC5 (compression, tension, bending, shear, torsion, combined actions, stability analysis), design of timber structural members for SLS according to EC5 (deformations, durability, fire resistance), design of single and multiple shear plane connections with metal dowel-type fasteners (nailed and bolted connections), punched metal plate fasteners, split ring connectors and toothed plate connectors, bonded connections, design of glued-laminated timber structures, configuration and design of roof structures and lattice girders, analysis of stress concentration sites in timber structures and constructive protection methods. Improved understanding and deepening of knowledge is supported by the presentation and comparative analysis of existing timber structures.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge
   1. Knows the materials, material models and material properties of timber structures, the effects that affect the material properties, strength grades of timber material according to EC5, as well as the theoretical and practical methods for the determination of characteristic strength,
   2. knows the dimensioning principles of timber structures in ULS and SLS for simple and combined actions as well as how to perform stability analyses,
   3. knows the behaviour and design principles of glued-laminated structures,
   4. knows the failure mechanism of dowel-type and complex mechanical connections, the typical configuration and design methods of different connection types,
   5. knows the configuration principles of modern roofs and lattice girders, as well as the most important aspects and principles of the strength analysis of these structures,
   6. knows the typical stress concentration sites in timber structures, and the most important constructive timber protection methods,
   7. knows the principles of fire design in case of timber structures.

B. Skills
   1. The student is able to determine the design strength and stiffness properties of timber structures in function of the load, the environmental conditions and the size of the structural element,
   2. the student is able to verify the strength, stability and deflection of timber structural members subjected to simple or combined actions,
   3. the student is able verify the strength, stability and deflection of different glued-laminated girders,
   4. the student is able to verify the load bearing capacity of a dowel-type or complex mechanical connection, as well as to design the connection considering the appropriate detailing rules,
   5. the student is able to model and verify a timber lattice girder or roof structure,
   6. the student is able to detect potential stress concentration sites, and improve the structure by applying an appropriate structural or connection configuration, He is able to consider the most important aspects of constructive protection methods during the design procedure,
   7. the student is able to verify the strength of a timber structural member or connection in case of fire event.

C. Attitudes
   1. The student is open to the application and design of modern timber materials, girder types, connections and dimensioning methods,
   2. the student makes an effort to accurate and error-free task solving,
   3. the student seeks to enforce the principle of energy efficiency and environmental awareness in the design of timber structures.

D. Autonomy and responsibility
   1. Independently performs the task of thinking and solving tasks and problems related to the dimensioning of timber structures,
   2. uses the systemic approach in its thinking.

2.3 Methods

Presentations, exercise classes, written and oral communication, use of IT tools and techniques, independent task solving, work organization techniques..

2.4 Course outline

week:	Topics of lectures and/or exercise classes
1.	Materials and material models of timber structures. The derivation of material properties, the effect of the individual factors on the strength.
2.	The strength grades of the timber structures (MSZ EN 338, MSZ EN 14080), theoretical and experimental methods for determining the characteristic strength.
3.	Requirements for modern timber structures in ultimate and serviceability limit states.
4.	Analysis of timber structures for combined actions, stability analyses (buckling, lateral torsional buckling).
5-6.	Strength analysis of bonded connections, structural configuration and technological requirements. Dimensioning of glued-laminated timber girders.
7.	Typical failure mechanism and design of dowel-type connections (bolted, nailed), detailing rules for dowel-type connections.
8.	Typical configuration and design of complex mechanical connections (split ring connectors, toothed plate connectors, punched metal plate fasteners).
9-10.	Stress concentration sites in timber structures and their analysis.
11.	Configuration and design of modern roof structures and lattice girders. Constructive protection methods.
12-13.	Modelling of fire effect for structural design. Design of timber structures in case of a fire event.
14.	Comparative analysis of existing timber structures.

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. J. Porteous, A. Kermani: *Structural timber design to Eurocode 5*. Blackwell Publishing Ltd, 2007. (recommended)

b) Online materials
   1. Introduction to the design of timber structures, Electronic Lecture Note.
   2. Material properties of timber structures, Electronic Lecture Note.
   3. Verification of timber structures in ULS and SLS, Electronic Lecture Note.
   4. Verification of timber structures for combined actions and stability analyses, Electronic Lecture Note.
   5. Design of glued-laminated structures, Electronic Lecture Note.

6. Dowel-type connections I., Electronic Lecture Note.
7. Dowel-type connections II., split ring and toothed plate connections I., Electronic Lecture Note.
8. Split ring and toothed plate connections II., nail plate connections, Electronic Lecture Note.
9. Timber roofs and lattice girders, Electronic Lecture Note.
10. Fire design of timber structures, Electronic Lecture Note.

2.6 Consultation

The instructors are available for consultation during their office hours, as advertised on the department website. Special appointments can be requested via e-mail: koris.kalman@mail.bme.hu

II. SUBJECT REQUIREMENTS

3 ASSESSEMENT 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 three tests.

3.2 Assessment methods

Evaluation form	abbrev.	**assessed learning outcomes**
1. control test	ED1	A.1-A.2; B.1-B.2; C.1-C.3; D.1-D.2
2. control test	ED2	A.3-A.4, B.3-B.4; C.1-C.3; D.1-D.2
3. control test	ED3	A.5-A.7, B.5-B.7; C.1-C.3; D.1-D.2

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

3.3 Evaluation system

abbreviation	**score**
ED1	50%
ED2	50%
ED3	50%
Total achievable during the semester	**100%**
Sum	**100%**

The test is not successful if the average of two better tests is less than 50% of the available points (15 points).

3.4 Requirements and validity of signature

No signature can be obtained from the subject.

3.5 Grading system

The final grade is determined according to the following criteria:
The final grade is calculated from the weighted average of the two better tests according to clause 3.3. Maximum 30 points can be obtained on each test. Extra points can be gained by the successful completion (≥50%) of the third (weakest) test. Extra points are calculated as 20% of the weakest (but successful) test (max. 6 points). The final grade based on the points:

grade	**points (P)**
excellent (5)	26 p ≤ P
good (4)	22 p ≤ P ≤ 25 p
satisfactory (3)	18 p ≤ P ≤ 21 p
passed (2)	15 p ≤ P ≤ 17 p
failed (1)	P < 15 p

3.6 Retake and repeat

1) There is no minimum requirement for individual mid-term benchmarking, therefore individual retake of the tests is not possible.

3.7 Estimated workload

activity	**hours/semester**
contact hours	14×2=28
preparation for the tests	3×16=48
home studying of the written material	14×1=14
in total	**90**

3.8 Effective date

September 1, 2017.