Alcali activated materials in civil engineering - BMEEOEMDTV1

I. Subject Specification

1. Basic Data

1.1 Title

Alkali activated materials in civil engineering

1.2 Code

BMEEOEMDTV1

1.3 Type

Module with associated contact hours

1.4 Contact hours

Type	Hours/week / (days)
Lecture	2

1.5 Evaluation

Exam

1.6 Credits

3

1.7 Coordinator

name	Dr. Kopecskó Katalin
academic rank	Associate professor
email	kopecsko.katalin@emk.bme.hu

1.8 Department

Department of Construction Materials and Technologies

1.9 Website

https://epito.bme.hu/BMEEOEMDTV1
https://edu.epito.bme.hu/course/view.php?id=2513

1.10 Language of instruction

english

1.11 Curriculum requirements

Ph.D.

1.12 Prerequisites

1.13 Effective date

1 September 2022

2. Objectives and learning outcomes

2.1 Objectives

During the last decades, alkali-activated cements and concretes have attracted strong interests all over the world due to their advantages of low energy cost, high strength and good durability compared to portland cements. A major incentive for further development of such cement is generated by the annual output of fly ashes from power plants and other by-product materials, which is so enormous that there is a constant need to find new uses for them. Approximately 49% of the utility wastes are simply landfilled, 41% are contained in surface impoundments, and about 10% are disposed of by discharging into old quarry operations.
Although much of the development of alkali-activated or alkaline cements has been based on activated slags, there is great potential for the utilization of other by-products, instead of using ordinary Portland cement.
Within the framework of the course, students get acquainted with the basics of the alkali-activated materials in civil engineering applications.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

1. Alkali-activated materials in the system of binders.
2. Alkali-activated binders versus Portland cement.
3. Precursors and activators.
4. Waste materials as secondary raw materials.
5. Liquid and solid activators.
6. Reactions between the different precursors and activators.
7. Differences and similarities with ternary or quaternary blended cement.
8. Applications. Alkali-activated cement. One or two-phase cement.
9. Prefabrication with alkali-activated materials.
10. Alkali activated stabilization in geotechnics.
11. Alkali activated materials versus geopolymers.
12. Durability properties.
13. The subject includes knowledge of the materials dealing with the above topics.

B. Skills

1. able to explain the differences between the Portland cement bound systems and alkali-activated bound systems (advantages and disadvantages),
2. capable of analyzing the alkali-activated systems and processes in many aspects.

C. Attitudes

1. develops his/her knowledge and is open to new information,

2. aspires to solve tasks accurately,
3. strive to maximize their abilities to make their homework at the highest possible level.

D. Autonomy and Responsibility

1. able to make state-of-the-art in a special field of the topic,
2. able to transfer the knowledge in the special field to the class during a short presentation,
3. take responsibility for the quality of your work and the ethical standards that set an example for your classmates, using the knowledge acquired during the course.

2.3 Methods

lectures and individual learning, review making and a short presentation by the PhD student.

2.4 Course outline

Alkali-activated materials in Civil Engineering practice, examples (geotechnics, prefabrication, etc.)

Hét	**Előadások és gyakorlatok témaköre**
1.	Introduction. Important terms: precursors and activator materials. Production and properties of some commonly used chemical a

		ctivators. Liquid and solid activators.
	2.	Precursors. Production and properties of cementing components used in alkali-activated cement and concrete - I.
	3.	Precursors. Production and properties of cementing components used in alkali-activated cement and concrete - II.
	4.	From binder to concrete 1. Hydr

		ation and microstructure of alkali-activated slag cement - I.
	5.	From binder to concrete 1. Hydration and microstructure of alkali-activated slag cement - II.
	6.	From binder to concrete 2. Properties of alkali-activated slag cement pastes and mortars - I.
	7.	From binder to concrete 2. Properties of alkali-ac

		tivated slag cement pastes and mortars - II.
	8.	From binder to concrete 3. Properties of alkali-activated slag cement concrete - I.
	9.	From binder to concrete 3. Properties of alkali-activated slag cement concrete -II.
	10.	Durability of alkali-activated cements and concrete.
	11.	Durability of alkali-activate

		d cements and concrete.
	12.	Other types of alkali-activated cementitious systems. Alkali-activated materials versus geopolymer.
	13.	Geopolymers. Standardization.

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. pdf versions of the Lectures
2. Shi - Krivenko - Roy: Alkali-Activated Cements and Concretes, Taylor and Francis, p. 376.
3. Provis - Deventer: Geopolymers, Woodhead Publishing in Materials, p. 454.

2.6 Other information

2.7 Consultation

Appointments can be requested via e-mail: kopecsko.katalin@emk.bme.hu.

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This Subject Datasheet is valid for:

2024/2025 semester II

II. Subject requirements

Assessment and evaluation of the learning outcomes

3.1 General rules

The assessment of the learning outcomes is specified in clause 2.2. above and the evaluation of student performance occurs via exams and homework. The homework will be presented in a short (10 minutes) presentation to the class.

3.2 Assessment methods

Teljesítményértékelés neve (típus)	Jele	Értékelt tanulási eredmények
Exam	E	A.1-A.12; B.1-B.2; C.1-C.2
Homework (+presentation)	H	A.1-A.12; B.1-B.2; 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

Jele	Részarány
E	50
H	50
Összesen	**100%**

3.4 Requirements and validity of signature

Active presence during the semester.

3.5 Grading system

Érdemjegy	Pontszám (P)
excellent (5)	85-100
good (4)	74-84
satisfactory (3)	62-73
passed (2)	50-61
failed (1)	0-49

3.6 Retake and repeat

Possible in the examination period (see in the Neptun system).

3.7 Estimated workload

Tevékenység	Óra/félév
Lectures	28
Individual study	16
Homework and presentation	46
Összesen	**90**

3.8 Effective date

1 September 2022

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