Subject datasheet

1. Subject specification

# Basic data

## Title

**CHEMISTRY FOR CIVIL ENGINEERS**

## Code

**BMEEOEMAT41**

## Type

Module with associated contact hours

## Contact hours

|  |  |  |
| --- | --- | --- |
| type | hours/week |  |
| lectures | 2 |  |

## Evaluation

midterm grade

## Credits

2

## Coordinator

name: Dr. Katalin Kopecskó

academic rank: associate professor

email: kopecsko.katalin@epito.bme.hu

## Department

Department of Construction Materials and Technologies (www.em.bme.hu)

## Website

[www.epito.bme.hu/](http://www.epito.bme.hu/)BMEEOEMAT41

## Language of instruction

Hungarian and English

## Curriculum requirements

Compulsory in the Civil engineering (BSc) programme

## Prerequisites

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## Effective date

September 1, 2017.

# Objectives and learning outcomes

## Objectives

During the semester students are gaining knowledge and experiences in the following topics: The structure of atoms, the electron shell structure, the structure of molecules and chemical bonds. Laws of gases and liquid systems, fluids. Structure and properties of crystalline and non-crystalline (amorphous or glassy) solids. Macromolecular substances. Characteristics and distinction between homogeneous and heterogeneous systems. Gibbs law. Interfacial phenomena. The types of chemical reactions, speed of chemical reactions. Chemical equilibrium. Acids, bases and salts. The pH concept. Hydrolysis of salts. Electrochemistry. Redox processes, redox potentials. Metals and corrosion. Binder materials. Cement chemistry.

## Learning outcomes

Upon successful completion of this subject, the student:

1. Knowledge
   1. acquires knowledge in general chemistry as well as ability using terms of chemistry,
   2. embraces knowledge concerning the important chemical laws,
   3. understands the main functions between the state parameters and material behaviour,
   4. understands the chemical explanation of the macroscopic properties of materials,
2. Skills
   1. able to explain chemical behavior of chemical substances,
   2. capable of analyzing chemical systems and processes in many aspects,
3. Attitudes
   1. develops his/her knowledge and is open to new possibilities
   2. aspires to know and use the tools solving chemical problems,
   3. aspires to solve tasks accurately,
4. Autonomy and responsibility
   1. carries out the specified design tasks/home assignments individually~~,~~
   2. applies the system-based approach in thinking.

## Methods

Lectures and tests.

## Course outline

|  |  |
| --- | --- |
| week: | Topics of lectures |
| 1. | The importance of learning chemistry. The structure of atoms, the electron shell structure. Periodic table. Chemical bonds I (ionic, covalent, dative and metallic). |
| 2. | Chemical bonds II. (hydrogen bond, Van der Waals bond) States of materials - explanation by intermolecular forces. Ideal and real laws of gases. |
| 3. | Properties of fluid systems (viscosity, Newtonian and non-Newtonian fluids). Structure and properties of solids 1.: crystalline solids (ionic, atomic, molecular and metallic lattice crystal structure and properties). |
| 4. | Real crystal structure. Difference between ideal and realistic structure, macroscopic properties of crystalline materials, lattice defects. Structure and properties of solids 2.: non-crystalline solids (amorphous or glassy solids) |
| 5. | Macromolecular substances and its structure. Explaining macroscopic properties of macromolecular materials by chemistry. |
| 6. | Macromolecular substances and its structure. Grouping by technology of production, main types and its properties. Homogeneous systems, properties, solutions and mixtures. Influencing parameters of dissolution, concentration. |
| 7. | Heterogeneous systems (colloid and disperse systems: aerosols, emulsions, suspensions, alloys, inclusions). Gibbs law. Phase diagrams. |
| 8. | Interfacial phenomena. Surface tension of liquids. Miscibility and immiscibility. |
| 9. | Capillary action. Wetting phenomenon. Elevation and depression of liquids in capillary tubes. Adsorption of gases. Emulsions. |
| 10. | The types of chemical reaction. Speed of chemical reactions. Activation energy and heat of reaction. Exothermic and endothermic reactions. Hess’s law. Chemical equilibrium. Law of mass action. |
| 11. | Electrochemistry: Redox processes (voltaic and electrolytic cells, cell potential, redox potentials). Standard hydrogen electrode, measuring pH values. Corrosion of metals (types of corrosion, influencing parameters of rate). |
| 12. | Binder materials 1.: Non-hydraulic inorganic binder materials (thermal transformation of gypsum and binding mechanism, production of lime, slaking and binding of lime, influencing properties. Thermal analyses. |
| 13. | Binder materials 2.: Hydraulic inorganic binder materials: silicate and aluminate cements, production and chemistry of cements. Chemical and mineralogical composition of cement clinkers. |
| 14. | Hydration products of clinkers and cements (CSH, CAH, CH). Role of primary ettringite formation. Ettringite – monosulphate transformation. Secondary ettringite formation. |

The above programme is tentative and subject to changes due to calendar variations and other reasons specific to the actual semester.

## Study materials

1. Online materials
   1. e-lecture notes: CAN BE DOWNLOADED FROM THE DEPARTMENT’S WEBSITE
   2. e- syllabus: CAN BE DOWNLOADED FROM THE DEPARTMENT’S WEBSITE

## Other information

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## Consultation

The lecturer is available for consultation during their office (consultation) hours, as it is advertised on the department website.

Special appointments can be requested via e-mail: kopecsko.katalin[@epito.bme.hu](mailto:oktato@epito.bme.hu)

1. Subject requirements

# Assessement and Evaluation of the learning outcomes

## General rules

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

## Assessment methods

|  |  |  |
| --- | --- | --- |
| **Evaluation form** | abbrev. | **assessed learning outcomes** |
| test 1 | T1 | A.1-A.4; B.1-B.2; C.1-C.3; D.1-D.2 |
| test 2 | T2 | A.1-A.4; B.1-B.2; C.1-C.3; D.1-D.2 |

The dates of midterm tests can be found in the detailed course schedule on the subject’s website.

## Evaluation system

|  |  |
| --- | --- |
| **abbreviation** | **score** |
| T1 | 50% |
| T2 | 50% |
| **Total achievable during the semester** | **100%** |
| **Sum** | **100%** |

## Requirements and validity of signature

Signature cannot be obtained.

## Grading system

Final grade for the project design task for students who comply the requirements of attendance is considered as follows:

|  |  |
| --- | --- |
| **grade** | **points (P)** |
| excellent (5) | 85<=P |
| good (4) | 74<=P<85% |
| satisfactory (3) | 63<=P<74% |
| passed (2) | 50<=P<63% |
| failed (1) | P<50% |

## Retake and repeat

1. The two tests may be retaken or repeated in aggregated form - for the first time - free of charge. In case of repair, the more favourable result will be considered.
2. If on the substitution described in point 1 the student cannot acquire at least passed result, a second attempt is made to repeat the unsuccessful first retake with paying the fee specified in the Code of studies and exams.

## Estimated workload

|  |  |
| --- | --- |
| **activity** | **hours/semester** |
| participation in lectures | 14×2=28 |
| preparation for the tests | 2×10=20 |
| home studying of the written material | 12 |
| **in total** | **60** |

## Effective date

September 1, 2017.