Technical Chemistry

Code: MK3MKEMK04GX17

ECTS Credit Points: 4

Evaluation: exam

Year, Semester: 1st year/2nd semester

Its prerequisite(s): -

Further courses are built on it: Yes/No

Number of teaching hours/week (lecture + practice): 2+1

Topics:

History and development of chemistry and its relation to other natural sciences. Basic definitions in chemistry: atoms, molecules, elements, compounds, mixtures, chemical symbols, chemical formulas, molar mass, chemical equations, the classification of chemical reactions. Development of atomic and molecular theory. The structure of atom. Basics of radioactivity. Discovery of the periodic table and periodically changing properties. Introduction to quantum chemistry. Primary and secondary chemical bonds. Description of gaseous, liquid and solid states of matter. Phase changes. Chemical equilibrium. Acid-base theories. Basics of thermochemistry, reaction kinetics and electrochemistry.

Literature:

Recommended:

- John McMurry – Robert C. Fay: Chemistry, 7th ed., Prentice Hall ISBN: 0321943171.
- Darrell D. Ebbing: General Chemistry, 9th ed. Belmont, CA, ISBN: 1-4390-4982-9
- James E. Brady, Gerard E. Humiston: General chemistry: principles and structure, 3rd ed., New York, Wiley, ISBN: 0471808164

Schedule

1st week Registration week	
2nd week: **Lecture:** Sciences and chemistry, Quantitative laws in chemistry, basic concepts of stoichiometry	**3rd week:** **Lecture:** Types of chemical reactions. The structure of atoms and nucleus. Atomic theories. Properties of subatomic particles (electron, proton, neutron). Isotopes.
4th week: **Lecture:** Radioactivity. Radioactive decay, decay series. The mass defect. Nuclear energy, nuclear fission and fusion. Characteristics of electromagnetic radiation.	**5th week:** **Lecture:** Heisenberg's uncertainty principle. Schrödinger's equation. Quantum numbers. Principles of the periodic table.
6th week: **Lecture:** Electronegativity, ionization energy, electronaffinity, atomic and ionic radii. Ionic bond. Metallic bonding.	**7th week:** **Lecture:** The covalent bond. Basics of the molecular orbital (MO) theory and the valence shell electron pair repulsion (VSEPR) model. The shape of molecules.
8th week: 1st drawing week	

9th week: **Lecture:** Intermolecular forces. London forces, dipole-dipole interaction and hydrogen bond. General characterization of molecular, ionic, metallic, and network atomic solids.	10th week: **Lecture:** General characterization of different states of matter. Gaseous, liquid and solid states. Phase changes. Properties of solutions and mixtures. Colligative properties.
11th week: **Lecture:** Basics of thermochemistry. Heat of reaction, Hess's law. Internal energy, enthalpy, free energy and entropy	12th week: **Lecture:** Reaction kinetics, fundamental concepts of reversible reactions, Le Chatelier's principle
13th week: **Lecture:** Solubility equilibria, acid-base theories, definition and calculation of pH. Amphoteric substances, buffer solutions and acid-base indicators	14th week: **Lecture:** Redox reactions, basics of electrochemistry. Standard electrode potentials. Quantitative laws of electrolysis. Galvanic cells and batteries.

15th week: 2nd drawing week

Practices in blocks!

Week 1 (2 hours)

1. General rules of laboratory work and using of laboratory equipment

1.1. Laboratory work and safety training

1.2. Introduction to laboratory equipment

Week 2 (6 hours)

1. Determination of BOD (Biochemical Oxygen Demand) values for different water samples by OxiTop® IS 12 BOD measuring system (Starting of measurement).

2. Investigation of water samples by MultiLine P4 portable electroanalytical set

Week 3 (6 hours)

1. Determination of BOD (Biochemical Oxygen Demand) values for different water samples by OxiTop® IS 12 BOD measuring system (Finishing and evaluation of measurement).

2. Mass and volume measurement

2.1. Introduction into the mass measurements with the overview of the metric and SI units and introduction into the concepts of precision and accuracy

2.2. Introduction into the volume measurements with determination of hydrochloric acid solution's precise concentration by acid-base titration

Requirements

A, for a signature and lab grade:

Attending practices is compulsory. Students must attend practice classes and may not miss any practice class during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Being late is equivalent with an absence. In case of absence due to health issues, a medical certification needs to be presented. Missed practice classes must be made up for at a later date, being discussed with the tutor.

The weekly syllabus covers the particular topics and gives a full description of the experiments.

Each week the laboratory session begins or closes with a short test (no more than 20 minutes) based exclusively on the preparatory material of that week and the previous week and the results of the experiments carried out the previous week. There are two short tests (2nd and 3rd week) during the semester. **Lab grading** is based on a five-level scale: 1 (fail), 2 (pass), 3 (satisfactory), 4 (good), 5 (excellent) calculated as an average of the tests' results

(the average of two short test) and measurement reports (the average of four measurement reports). The minimum requirement for the short tests is 50%.

B, for a grade:

The course ends in an examination. The result of the examination determines the final grade. 15 % of the total score comes from the result of the laboratory practice, while 85 % can be obtained on the written exam.

The minimum requirement for the examination is 50%. Based on the total score, the grade is given according to the following (score/grade):

0-49 % = fail (1); 50-62 % = pass (2); 63-75 % = satisfactory (3); 76-87 % = good (4); 88-100 % = excellent (5)

If the case of failure, students can take retake exam(s) in conformity with the EDUCATION AND EXAMINATION RULES AND REGULATIONS.