UNIVERSITY of NICOSIA

Course Syllabus

Course Code	Course Title	ECTS Credits
CHEM-106	General Chemistry	8
Prerequisites	**Department**	**Semester**
None	Life & Health Sciences	Fall, Spring
Type of Course	**Field**	**Language of Instruction**
Required	Chemistry	English
Level of Course	**Lecturer(s)**	**Year of Study**
1st Cycle	Dr. Stavroula Y. Christou	1st Year
Mode of Delivery	**Work Placement**	**Corequisites**
Face-to-face	N/A	N/A

Course Objectives:

The main objectives of the course are to:

- Provide engineering students with an introduction to the basic principles of general, physical, and organic chemistry.
- Assist in the development of strong problem-solving skills.
- Help cultivate critical thinking in the approach to learning.
- Help in the acquisition of sound hands-on practical skills in the chemistry lab.

Learning Outcomes:

After completion of the course students are expected to be able to:

1. Use the concept of significant figures in calculations, and in particular, to apply the rules of significant figures when using laboratory measurements and in the analysis of experimental data.
2. Explain the atomic and molecular structure and discuss the arrangement of atoms or molecules in different forms of matter.
3. Utilize qualitatively and quantitatively chemical equations for a variety of chemical reaction types.
4. Use the principles of quantum mechanics in atoms and discuss how the electronic structure can be employed to provide explanation for the periodic trends of various properties.

5. Discuss the basic principles of chemical bonding including the application of molecular orbitals in the description of covalent bonding.
6. Explain the behavior of ideal and real gases, liquids and solids.
7. Use the basic principles of thermochemistry to predict the heat transfer involved in chemical combustion processes.
8. Use the basic principles of chemical kinetics and chemical equilibria to explain the speeds and efficiencies of chemical processes.
9. Combine the enthalpy change with the change in the randomness or disorder that accompanies of a chemical reaction, and understand the idea of spontaneous processes.
10. Discuss the basic principles of electrochemistry, including redox equations, voltaic cells, batteries and fuel cells.
11. Explain the process of corrosion and discuss the factors that contribute to this chemical change, with emphasis on the rusting of iron.
12. Discuss the nature of organic compounds by studying their chemical structure and reactions, the types of hydrocarbons, and the functional groups.
13. Name organic compounds and discuss the physical and chemical properties of saturated, unsaturated and aromatic hydrocarbons.

Course Content:

Theory:

- Matter and measurement: classification of matter, physical and chemical properties of matter, units of measurement, uncertainty in measurement and dimensional analysis.
- Atoms, molecules and ions: atomic theory, atomic structure, ions, molecules, ionic and molecular compounds, nomenclature of inorganic compounds.
- Stoichiometry: balancing chemical equations, types of chemical reactions, molecular and empirical formulas, Avogadro's number and mole, calculations with chemical formulas and equations, percent composition and combustion analysis.
- Aqueous reactions and solution stoichiometry: properties of aqueous solutions, solubility rules, precipitation reactions, acids, bases and neutralization reactions, concentration, solution stoichiometry.
- Electronic structure of atoms: quantum mechanics, atomic orbitals, electron configurations and the periodic table.
- Periodic properties of elements: metals, nonmetals, and metalloids, periodic trends in the sizes of atoms and ions, ionization energy and electron affinities.
- Chemical bonding: Lewis symbols and structures, the octet rule, ionic, covalent and metallic bonding, bond polarity and electronegativity, bond strength.
- Gases, liquids and solids: gas characteristics, gas laws, the ideal-gas equation, real gases, intermolecular forces, properties of liquids, phase changes and phase diagrams, structure and classifications of solids.
- Thermochemistry: kinetic and potential energy, the first law of thermodynamics, heat and

work, enthalpy, enthalpies of formation and reaction (endothermic and exothermic reactions), Hess's law, calorimetry, energy in food and fuels.
- Chemical kinetics: reaction rates, rate laws, reaction orders, collision model, Arrhenius equation and activation energy, reaction mechanism, catalysis.
- Chemical equilibrium: equilibrium constants, homogeneous and heterogeneous equilibria, le Châtelier's principle.
- Thermodynamics: spontaneous processes, entropy, the second law of thermodynamics, entropy changes, Gibbs free energy.
- Electrochemistry: oxidation numbers, oxidation-reduction reactions, balancing redox reactions, voltaic cells and cell potentials, Nernst equation, batteries and fuel cells, corrosion, electrolysis.
- Organic chemistry: nomenclature, structure, properties and reactions of organic compounds, alkanes, alkenes, alkynes and aromatic hydrocarbons, functional groups (alcohols, ethers, aldehydes, ketones, carboxylic acids, esters, amines and amides).

Laboratory Experiments:

- Laboratory Safety Demonstrations
- Experiment 1: Basic Laboratory Techniques
- Experiment 2: Experimental Determination of Density
- Experiment 3: Preparation of Solutions of Known Concentrations / Spectrophotometric Techniques in Chemistry
- Experiment 4: Estimation of the Molar Mass of Carbon Dioxide (CO_2) Gas
- Experiment 5: Molar Heat of Solution for Ionic Solids
- Experiment 6: Determination of the Rate Law and Activation Energy
- Experiment 7: Determination of the Dissociation Constant of Acetic Acid
- Experiment 8: Solubility-Polarity of Organic Compounds

Learning Activities and Teaching Methods:

Lectures, Laboratory Practical Sessions, and Assignments.

Assessment Methods:

Lab Attendance/Reports, Mid-Term Test, Final Exam

Required Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Chemistry The Central Science	T.L. Brown, H.E. Lemay, B.E. Bursten, C.J. Murphy	Prentice Hall	2009 11th Edition	0-13-235848-4
P.G. Hajigeorgiou	CHEM-105 Laboratory Manual	University of Nicosia	2010	

Recommended Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Chemistry	Raymond Chang	McGraw Hill, 10th edition	2010	978-0-07-351109-2
Chemistry	John E. McMurry, Robert C. Fay, Jordan Fantini	Pearson Prentice Hall, 6th edition	2012	0-321-76087-5
General Chemistry	Darrell D. Ebbing, Steven D. Gammon	Houghton Mifflin Company	2009	0-618-85748-6