DOGUS UNIVERSITY
COURSE OUTLINE

FACULTY	**ARTS AND SCIENCES**
DEPARTMENT	**CHEMISTRY**
CODE	**CHEM 101**
TITLE	**CHEMISTRY**
CREDIT	**3**
PREREQUISITE	**NONE**
INSTRUCTOR	**ASST.PROF.DR.AYŞEN TULPAR**

PURPOSE

To give the freshmen engineering students a background on the structure of matter, stoichiometry, chemical reactions in solutions, properties of gases and solutions, thermodynamics, kinetics and reaction rates, and chemical equilibria. To show the students how nature behaves around us, and how scientific method is applied to understand nature. Most importantly, this course aims to teach the students how to approach problems in a step-by-step fashion, which can be applied to any type of problem in chemistry or in any other field of science and/or engineering.

COURSE DESCRIPTION

Chemical foundations, atoms, molecules and ions, modern atomic theory, stoichiometry of chemical reactions, chemical calculations, chemical compounds and naming them, reaction in solutions, precipitation, acid-base neutralization and oxidation-reduction (redox) reactions, gases, thermochemistry, periodic table and its properties, properties of solutions, chemical reaction kinetics and principles of chemical equilibrium. Laboratory experiments and computer simulation (virtual) laboratories also accompany the lectures.

METHOD

a) Interactive lecturing
b) Concepts supported by example problems
c) Certain experiments carried out in chemistry lab
d) Certain experiments carried out in the computer simulation (virtual) lab

MAIN TEXT

Chemistry: The Central Science, T.L. Brown, H.E. Lemay, B.E.Burnsten, and C.J. Murphy, 11th Ed., Prentice-Hall, 2009

ADDITIONAL READINGS

1) *Chemistry*, Steven S. Zumdahl and Susan A. Zumdahl, 5th Ed., 2000, Houghton Mifflin Co.
2) *Chemistry: Matter and Its Properties*, Bradly and Holums, 3rd Ed. 2000, Wiley
3) *General Chemistry: Principles and Modern Applications*, R.H. Petrucci,W.S. Harwood, 9th Ed. 2008, Prentice Hall

EVALUATION

1) Two Major Exams: *40%* (*20% each*)
2) Homework, pop quizzes, class participation, experimental labs.: *20%*
3) Final Exam: *40%*

TEACHING PLAN

Week 1

Chapter 1. Introduction: Matter and Measurement

Definition of chemistry, scientific method, units and measurements, uncertainty in measurements, accuracy and precision, significant figures, mathematical calculation with significant figures, conversion factors, dimensional analysis, temperature and temperature scales, density as an identification tag, matter and its classification

Week 2

Chapter 2. Atoms, Molecules and Ions

Fundamental chemical laws: Law of conservation of mass, law of definite proportions, law of multiple proportions, atomic theories and related experiments, Dalton's atomic theory, modern view of atomic structure, molecular and ionic compounds, chemical bonds, introduction to periodic table, metals, non-metals and metalloids, naming simple compounds: Binary ionic compounds types I and II, ionic compounds with polyatomic ions, binary covalent compounds (type III), acids and naming them.

Week 3 and 4

Chapter 3. Stoichiometry: Quantitative Chemical Relationships

Atomic masses, mole concept, molar mass, percent composition of compounds, determining the formula of a compound, empirical formula, molecular formula, chemical equations, chemical reactions, the meaning of a chemical equation, balancing chemical equations, stoichiometric calculations: amounts of reactants and products, limiting and excess reactants, calculations involving limiting reactants, yield and related calculations

Week 5 and 6

Chapter 4. Types of Chemical Reaction and Solution Stoichiometry

Definition of solution, solvent, solute, H_2O as a common solvent, nature of aqueous solutions, strong and weak electrolytes, non-electrolytes, composition of solutions, dilute, concentrated and saturated solutions, molarity, precipitation reactions, acid-base reactions, nature of acids and bases, acid strength, pH-scale, calculating pH of strong acids, oxidation-reduction (redox) reactions, oxidation states, rules on solubility, balancing redox reactions, oxidizing and reducing agents, titrations in aqueous solutions

Week 7 , 8 and 9

Chapter 5. Thermochemistry

Nature of energy, conservation of energy, chemical, kinetic, and potential energies, enthalpy, calorimeter, Hess' law, heat of reaction, standard heat of formation, present sources of energy, new energy sources.

Week 9 and 10

Chapter 10. Gases

Gas laws of Boyle, Charles, Guy-Lussac, Avogadro's principle, ideal gas and combined gas laws, gas stoichiometry, Dalton's law of partial pressures, kinetic molecular theory of gases, meaning of temperature, root mean square velocity, effusion and diffusion, real gases.

Week 11

Chapter 13. Physical Properties of Solutions

Solution composition, energies of solution formation, solubility and factors affecting solubility, temperature, pressure and structure effects on solubility, vapor pressure of solutions, ideal and non-ideal solutions, boiling point elevation (increase) and freezing point depression (decrease), osmosis and osmotic pressure, reverse osmosis, colligative properties of electrolyte solutions, colloids

Week 12 and 13

Chapter 14. Chemical Kinetics

Reaction rates and rate laws, order of reactions, determining the form of the rate law, differential and integrated rate equations, reaction mechanism, model for chemical kinetics, catalyst and catalysis (homogenous and heterogeneous)

Week 13 and 14

Chapter 15. Chemical Equilibrium

The equilibrium condition, characteristics of chemical equilibrium, equilibrium constant, equilibrium involving pressures, heterogeneous equilibria, extent of reaction, calculation of equilibrium pressures and concentrations, Le Chatelier principle.