**CHEM 107 SYLLABUS**

**Text book: Raymond Chang, Chemistry, 10th edition, 2010**

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| Topics | Text book pages | Number of Lectures |

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| ***Chapter 7: Quantum theory and Electronic Structure of Atoms*** | | |
| **Bohr’s atomic theory** | | |
| * + Speed, length, frequency, number of the waves of light   + Plank’s equation (The quantization of light energy)   + The photoelectric Effect (The matter nature of light)   ***Exercises*** | 277 -287 | **3** |
| * + Assumptions of Bohr’s theory for hydrogen atom   ***Exercises*** |

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| Electronic structure of atoms | | | |
| * + De Broglie hypothesis (The dual nature of electrons)   + Heisenberg principle (Quantum mechanics and atomic orbitals)   *Exercises* | 288 - 304 | | **4** |
| * + The three quantum numbers of the distribution of electrons in atoms   *Exercises* |
| * + The energies of orbitals (The aufbau, building up, or n + *l* principle)   *Exercises* |
| * + Electron configurations   + The Pauli exclusion principle * Diamagnetism and paramagnetism * The shielding effect   + Hund’s rule   *Exercises* |
| * + Irregularities of configurations in transition elements   *Exercises* |
| *Chapter 8: Periodic Relationships Among the Elements* | | | |
| The periodic table | | | |
| * + Periodic classification of elements   *Exercises* | 326 - 352 | **3** | |
| * + Representing free elements in chemical equations   + Electron configurations of cations and anions   *Exercises* |
| * + Periodic variation in physical properties of elements: * Atomic radius * Ionization energy * Electron affinity   *Exercises* |

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| *Chapter 9: Chemical bonding Ι: Basic Concepts* | | | |
| * + Lewis dot symbols   + The ionic bond   + The covalent bond   *Exercises* | 366 - 395 | | **5** |
| * + Electronegativity and oxidation numbers   *Exercises* |
| * + Steps of drawing Lewis structures   + Formal charge and Lewis structure   *Exercises* |
| * + The concept of resonance   *Exercises* |
| * + Bond energy (enthalpy)   *Exercises* |
| FIRST MIDTERM EXAM | | | |
| *Chapter 10: Chemical bonding ΙΙ: Molecular Geometry and Hybridization of Atomic Orbitals* | | | |
| Molecular geometry and hybridization of atomic orbitals | | | |
| * + Molecular geometry   + Dipole Moment   *Exercises* | 410 - 449 | | **5** |
| * + Valence bond theory   + Hybridization of atomic orbitals (sp3, sp2, and sp)   *Exercises* |
| * + Hybridization in molecules   + Molecular orbital theory   *Exercises* |
| * + Molecular orbital configurations   + Delocalized molecular orbitals of benzene   *Exercises* |
| *Chapter 11: Intermolecular forces and Liquids and Solids* | | | |
| * + The kinetic molecular theory of gases   + Role of van der Walls forces in deviation of real gases from the ideal behavior and van der Walls equation   *Exercises* | 201 – 207 *(from chapter 5)* | | **5** |
| * + The kinetic molecular theory of liquids and solids   + Intermolecular forces   *Exercises* | 462- 469 | |
| * + Properties of liquids * Vaporization and vapor pressure * Surface tension * Viscosity * Structure and properties of water   *Exercises* | 469 - 272 | |
| *Chapter 13: Chemical Kinetics* | | | |
| * + Definition of the reaction rate   + Reaction rate and stoichiometry   *Exercises* | 558 - 587 | | **5** |
| * + Effect of concentration on the reaction rate (determination of the rate law, the rate constant units)   *Exercises* |
| * + The integral rate law of the first-order reactions and half-life   *Exercises* |
| * + Effect of temperature on the reaction rate (The collision theory, activation energy diagrams, and Arrhenius equation)   *Exercises* |
| SECOND MIDTERM EXAM (10 GRADS) | | | |
| *Chapter 14: Chemical equilibrium* | | | |
| * + Reversible reactions and the concept of equilibrium   + Equilibrium constant in terms of rate constants and in terms of molarities (Kc)   + Kc and Kp of homogenous and heterogenous gaseous reactions   *Exercises* | 616 – 643 | | **5** |
| * + What does the equilibrium constant tell us? (Q versus K) [Pages: 632 – 634] |
| * + Calculating the equilibrium constant and concentrations   *Exercises* |
| * + Factors affecting equilibrium position and constant (Le Chatelier’s principle) * Effect of changing concentrations * Effect of changing pressure/volume * Effect of changing temperature   *Exercises* |

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| *Chapter 15: Acid-bases* | | | |
| * + Acids-base properties of water   + Bronsted acids and bases   *Exercises* | 660 - 680 | | **4** |
| * + Strength of acids and bases   + Weak acids and weak bases ionization constants   *Exercises* |
| * + Conjugated acids and bases and relation between their Ka and Kb   *Exercises* |
| *Oxidation-reduction reactions (Redox reactions) from chapter 4 & 19* | | | |
| * + The two half-reactions   + Oxidation numbers and rules of assigning oxidation numbers   + Balancing redox reactions   *Exercises* | 135 – 138  838 -840 | | **3** |
| TOTAL HOURS | **42** | | |