**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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| Topics | Text book pages  | Number of lectures |
| *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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| Topics | Text book pages  | Number of lectures |
| *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 – 138838 -840 | **3** |
| TOTAL HOURS | **42** |