**CHEM 231 Course Objectives**

**Chapter 1 – Bonding and Structure**

1. apply Lewis dot structure drawing to organic molecules
2. extend the concept formal charges to organic structures
3. distinguish between constitutional and stereoisomers
4. interpret different structural representations of organic molecules correctly
5. understand and apply the concept of resonance forms
6. comprehend the wave character of subatomic particles and develop a qualitative understanding of the foundations of quantum mechanics
7. apply molecular orbital concepts and hybridization to simple organic molecules
8. extend molecular orbital theory concepts to alkanes, alkenes and alkynes
9. apply VSEPR theory to predict the shapes of molecules

**Chapter 2 – Families of Carbon Compounds**

1. distinguish and apply different graphical representations of organic molecules
2. predict polarities of organic molecules based on their shapes and formal charges
3. extend the concept of polar vs. non-polar bonds to a continuum of incremental bond polarities
4. apply the concept of functional groups to molecules
5. identify the most common functional groups by name and structure
6. relate physical properties to molecular structures
7. understand the principles of IR spectroscopy
8. apply IR spectroscopy to identify common functional groups

**Chapter 3 – Acids and Bases**

1. apply the curved arrow designation to acid-base reactions
2. extend the acid-base concept from Bronsted’s definition to Lewis’ definition
3. gain a basic understanding of the importance of carbocations and carbanions
4. extend the concept pK values and acid-base reactions beyond those observed in aqueous media
5. predict the outcomes of acid base reactions
6. relate structural features to compound acidities
7. apply the concept of free energy changes to acid-base reactions
8. relate functional groups to acidity
9. predict the effect of solvents on acidity
10. reinterpret organic reactions as generalized acid-base reactions

**Chapter 4 – Nomenclature and Conformations of Alkane and Cycloalkanes**

1. identify alkanes and cycloalkanes
2. relate carbon hybridization to alkane shapes
3. use IUPAC rules to name alkanes an cycloalkanes
4. use IUPAC rules to name alkenes
5. use IUPAC rules to name alkynes
6. relate the structures of hydrocarbons to their physical properties
7. understand the concept of conformational changes
8. predict ring and angle strain in cycloalkanes
9. visualize the conformations of cyclohexanes using models
10. identify and name substituted cycloalkanes
11. name polycyclic alkanes

**Chapter 5 – Stereochemistry**

1. understand the concept of chirality
2. extend the concept of isomerism to chiral molecules
3. relate to the biological importance of chiral molecules
4. identify and name chiral molecules
5. compare the physical properties of stereoisomers
6. relate chirality to optical activity
7. extend the naming of chiral compounds to those with multiple chiral centers
8. understand the concept of meso forms
9. interconvert Fisher projections and Wedge formulas
10. study the stereoisomers of cyclic compounds using models
11. predict possible stereochemical outcomes of organic reactions
12. apply the concept of chiral resolution
13. extend the concept of chirality to molecules lacking chiral carbons

**Chapter 6 – Nucleophilic Reactions**

1. study the properties of alkyl halides
2. understand the concept of nucleophiles and leaving groups
3. relate the mechanism of an SN2 reaction to its kinetics
4. relate the mechanism of an SN1 reaction to its kinetics
5. investigate specific cases of nucleophilic substitutions
6. consider the stereochemistry of nucleophilic substitutions
7. investigate carbocations in more depth
8. predict factors affecting the rates of nucleophilic substitutions
9. study solvent effects on nucleophilic substitutions
10. compare basicity to nucleophilicity

**Chapter 7 – Alkenes and Alkynes I**

1. apply the E-Z system for naming alkenes
2. predict the relative stabilities of alkenes
3. study ways to prepare alkenes: dehydrohalogenation
4. understand the mechanism of an E2 reaction
5. understand the mechanism of an E1 reaction
6. investigate the competition between elimination and substitution
7. extend ways to prepare alkenes: dehydration
8. understand carbocation rearrangements during E1 reaction
9. investigate ways to prepare alkynes
10. study anions derived from terminal alkynes as nucleophiles
11. investigate the first example of an addition: hydrogenation

**Chapter 8 – Alkenes and Alkynes II**

1. comprehend the principles of electrophilic addition
2. apply the principles of electrophilic addition to hydrogen halide additions
3. apply the principles of electrophilic addition to hydrogen hydrations
4. apply the principles of electrophilic addition to oxymercurations
5. revisit electrophilic additions in the context of Markovnikov’s rule
6. investigate hydroboration
7. study the electrophilic additions of halogens
8. revisit electrophilic additions in the context of stereochemistry
9. understand solvent participation: halohydrin formation
10. imagine divalent carbon: carbenes
11. prepare alkynes by double elimination
12. investigate the oxidation of alkenes an alkynes

**Chapter 9 – Nuclear Magnetic Resonance Spectroscopy and Mass Spectrometry**

1. understand the principles underlying NMR spectroscopy
2. lean to interpret chemical shifts
3. lean to interpret spin splitting patterns
4. understand magnetic equivalency
5. consider dynamic processes in NMR spectroscopy
6. investigate 13C NMR spectroscopy
7. understand the principles underlying mass spectrometry
8. understand the significance of molecular ions and fragmentation patterns
9. recognize isotope patterns in mass spectrometry

**Chapter 10 – Radical reactions**

1. investigate conditions leading to radical formation
2. study the geometry of radicals
3. explore relative radical stabilities
4. understand radical chain processes and predict regioselectivities
5. explore resonance stabilized benzylic and allylic radicals