Today's Date: 01/26/2016

Course ID: CHEM V12A
CC Approval: 04/02/2013
Effective Term: Fall 2013

Ventura College

COURSE OUTLINE OF RECORD

I. **Course Information** (Printed catalog data elements)

A. Discipline:
Chemistry

B. Course ID:
CHEM V12A

C. Course Title: General Organic Chemistry I
D. Units: 3.00
E. Hours:

Lecture/wk: 3.00
Total Semester Contact Hours (based on 17.5 week semester): 52.50

F. Prerequisite(s):
CHEM V01B and CHEM V01BL with grades of C or better

G. Corequisite(s):
None

H. Recommended preparation:
None

I. Enrollment Limitation:
None

J.
Description:

This course stresses molecular structure, chemical and physical properties, and the preparation of organic compounds with an emphasis on reaction mechanisms, structure determination, synthesis, and applications.

K. Former course ID: Chem 12A
L. Transfer Status:
CSU Recommended
UC Recommended

II. **Course Objectives**

- Upon successful completion of this course, the student will be able to demonstrate the following measurable skills and abilities:
  A. Categorize, arrange, and assemble structures of alkanes, alkenes, alkynes, alkyl halides, alicyclics, alcohols, ethers, and aromatics using IUPAC, derived, and common systems of nomenclature.
  B. Examine, evaluate, and formulate mechanisms for the reactions of alkanes, alkenes, alkynes, alkyl halides, alcohols, and aromatics given reactant and target compounds, and propose alternate steps in reaction

mechanisms for common reactions.

C. Examine, evaluate and formulate appropriate multi-step synthetic pathways leading to target compounds involving alkanes, alkenes, alkynes, alkyl halides, alcohols, and aromatics.

D. Evaluate spectra (infrared, mass, HNMR, CNMR, UV) to formulate structures for organic compounds involving alkanes, alkenes, alkynes, alkyl halides, alcohols, and aromatics.

E. Analyze stereochemistry by building models and drawing three-dimensional models of alkanes, alkenes, alkynes, alkyl halides, alcohols, and aromatics.

F. Investigate organic chemical reactions, by evaluating chemical data, constructing hypotheses, and applying the scientific method to formulate conclusions based on logical analysis of the available information.

III. **Course Content**

1. Structure and bonding (1 week)
   a. Atomic structure
   b. Bonding theories
      i. Valence bond theory
      ii. Molecular orbital theory
      iii. Hybridization
2. Polar bonds and their consequences (1 week)
   a. Electronegativity and bond polarity
   b. Formal charge
   c. Resonance
   d. Acids and bases
      i. Bronsted-Lowry
      ii. Lewis
   e. Organic acids and bases
   f. Chemical structures and models
3. Alkanes and cycloalkanes (1 week)
   a. Functional groups
   b. Isomers
   c. Alkyl groups
   d. Nomenclature
   e. Properties of alkanes
4. Stereochemistry of alkanes and cycloalkanes (1 week)
   a. Conformations of alkanes and cycloalkanes
      i. Cis-trans
      ii. Mobility
      iii. Confomational analysis of cyclo
   b. Stability of unsubstituted and substituted alkanes and cycloalkanes
      i. Heat of combustion
      ii. Ring strain
   c. Conformations of polycyclic molecules
5. An Overview of organic reactions (1 week)
   a. Mechanisms of radical reactions and polar reactions
   b. Describing a reaction:
      i. Equilibria
      ii. Rates
      iii. Energy changes
      iv. Using curved arrows
   c. Bond dissociation energies
   d. Energy diagrams and transition states and intermediates
6. Alkenes: structure, reactivity and synthesis (2 week)
   a. Degree of unsaturation

b. Naming alkenes
c. Electronic structure of alkenes
d. Cis-Trans isomerism in alkenes
e. Sequence rules: The E,Z designation
f. Alkenes: structure, reactivity and stability
g. Electrophilic addition of HX to alkenes
h. Orientation of electrophilic addition: Markovnikov's rule
i. Addition of halogens to alkenes
j. Oxidation and reduction of alkenes
k. Polymers

7. Alkynes (1 week)
   a. Nomenclature and electronic structure of alkynes
   b. Preparation of alkynes: elimination reactions of dihalides
   c. Reactions of alkynes
      i. Hydration of alkynes
      ii. Reduction of alkynes
      iii. Oxidative cleavage of alkynes
      iv. Acidity
      v. Synthesis
8. Stereochemistry (1 week)
   a. Enantiomers and the tetrahedral carbon
   b. Specific rotation
   c. Sequence rules for specification of configuration
   d. Diastereomers and meso compounds
   e. Molecules with more than two chirality centers
   f. Racemic mixtures and their resolution
   g. Physical properties of stereoisomers
   h. Fischer projections and assigning R,S
   i. Stereochemistry of reactions
9. Alkyl Halides (1 week)
   a. Naming, structure, and preparation of alkyl. halides alkyl halides
   b. Radical halogenation of alkanes
   c. Allylic bromination of alkenes
   d. Stability of the allyl radical
   e. Preparing alkyl halides from alcohols
   f. Reactions of alkyl halides: grignard reagents
   g. Organometallic coupling reactions
10. Reactions of alkyl halides: substitutions and eliminations (1 week)
   a. Stereochemistry of nucleophilic substitution
   b. The SN1 and SN2 reactions and kinetics
   c. Kinetics of the SN1 reaction
   d. Elimination reactions of alkyl halides: Zaitsev's rule
   e. The El and E2 reaction
11. Structure determination: mass spectrometry and infrared spectroscopy (1 week and continued throughout the course)
   a. Interpreting mass spectra
   b. Interpreting mass-spectral fragmentation patterns
   c. Functional groups
   d. Interpreting infrared spectra
   e. Infrared spectra of some common functional groups
12. Resonance spectroscopy (1 week and continued throughout the course)
   a. Nuclear magnetic resonance spectroscopy resonance Spectroscopy

b. Chemical shifts
c. Characteristics of ^{13}C NMR spectroscopy
d. DEPT ^{13}C NMR spectroscopy
e. Uses of ^{13}C NMR spectroscopy
f. ^{1}H NMR spectroscopy and proton equivalence
g. Integration of ^{1}H NMR absorptions: proton counting
h. Spin-spin splitting in ^{1}H NMR spectra

13. Conjugated dienes and ultraviolet spectroscopy (1 week)
    a. Preparation of conjugated dienes
    b. Stability of conjugated dienes
    c. Molecular orbital description of 1,3-butadiene
    d. Electrophilic additions to conjugated dienes: allylic carbocations
    e. Kinetic versus thermodynamic control of reactions
    f. The Diels-Alder cycloaddition reaction
    g. Interpreting ultraviolet spectra: the effect of conjugation
14. Benzene and aromaticity (1 week)
    a. Naming aromatic compounds
    b. Structure and stability of benzene
    c. Molecular orbital description of benzene
    d. Aromaticity and the Huckel 4n+2 rule
    e. Aromatic ions
    f. Pyridine and pyrrole: two aromatic heterocycles
    g. Naphthalene: a polycyclic aromatic compound

52.5 hours total lecture content

Total Lecture Content Hours:

IV. Lab Content:

Total Lab Content Hours:

V. **Assignments**

A. **Representative In-class Assignments** that develop critical thinking (required for degree applicable courses) may include, but are not limited to:

Student Activities:	Write composition(s) and/or report(s) and/or essay(s)	Write research paper(s) and/or term paper(s) and/or other paper(s)	Solve computational and/or symbolic problems	Conduct and experiment or survey	Engage in analytical discussions	Prepare oral presentations	Develop skills in performance/activities	Create and analyze projects	Other (specify below)
Critical Thinking Skills	**Student Activities involved in each skill**								
Evaluating	✓		✓		✓				
Appraising and assessing	✓		✓		✓				
Justifying	✓		✓		✓				
Synthesizing	✓		✓		✓				

Developing and formulating	✓		✓		✓				
Analyzing	✓		✓		✓				
Solv problems	✓		✓		✓				
Applying principles	✓		✓		✓				
Comprehending concepts	✓		✓		✓				
Identifying knowledge	✓		✓		✓				
Other (describe): Comments:									

B. **Representative Out-of-class Assignments**

Reading: Read approximately 40 pages per week from text. (2 hours per week)
Writing: Minimum 1 page per week (1 hour per week)
Problem solving: Approximately 20 problems, 1 multi-step synthesis and 1 spectral analysis per week. (3 hours per week)
Research: On-line research required for spectra identification
Library Work: 3-5 hours per semester as needed
Skills practice: -
Other: Total outside study 105 hours
Total Outside Assignments Hours:

VI. **Representative Instructional Modes -**

Lecture
Audio Visual Presentations
Collaborative Group Work
Computer-aided Presentation/Assignments
Demonstrations
Independent Study
One-on-one conference
Small group activities

VII. **Evaluation Methods -** Substantively related to the course objectives.

A. **Writing.**
essay exam(s)
written homework

B. **Problem Solving.** Computational or non-computational problem-solving demonstrations, including:
exam(s)
quiz(zes)
homework problem(s)
other (specify) : On-line Exercises

C. **Skills demonstrations.** Including:
active and informed participation
other (specify) : On-line Exercises

D. **Objective examinations.** Including:
multiple choice
true/false
matching items
completion

VIII. **Textbooks**

List representative textbooks, manuals, and other instructional materials/publications, including those materials to be put in the Library/LRC(Learning Resources Center).

Author(s)	Title(s)	Publisher(s)	Date(s)
Bruice P	Organic Chemistry	Pearson	2011

Other appropriate publications/instructional materials such as representative recommended readings, repertoire, non-print media (eg.,websites, audio/visual recordings), and software.

Other

Other Appropriate Publications:

Discipline-specific websites: Yes

IX. **Minimum Qualifications**

Chemistry (Masters Required)

X. **Student Learning Outcomes**

CSLO-1 Categorize, arrange and assemble structures of alkanes, alkenes, alkynes alkyl halides, alicyclics, alcohols, ethers and aromatics using IUPAC, derived and common systems of nomenclature.

CSLO-2 Examine, evaluate and formulate mechanisms for the reactions of alkanes, alkenes, alkynes, alkyl halides, alcohols and aromatics given reactant and target compounds. They will also be required to propose alternate steps in reaction mechanisms for common reactions.

CSLO-3 Examine, evaluate and formulate appropriate multi-step synthetic pathways leading to target compounds involving alkanes, alkenes, alkynes, alkyl halides, alcohols and aromatics.

CSLO-4 Evaluate spectra (infrared, mass, HNMR, CNMR, UV) to formulate structures for organic compounds involving alkanes, alkenes, alkynes, alkyl halides, alcohols and aromatics.