GROSSMONT COLLEGE

COURSE OUTLINE OF RECORD

Curriculum Committee Approval: 04/26/2022

GCCCD Governing Board Approval: 06/14/2022

CHEMISTRY 231 – ORGANIC CHEMISTRY I

1. Course Number Course Title Semester Units

CHEM 231 Organic Chemistry I 5

Semester Hours

3 hours lecture: 48-54 hours 96-108 outside-of-class hours

6 hours lab: 96-108 hours 240-270 total hours

2. Course Prerequisites

A “C” grade or higher or “Pass” in Chemistry 142 or equivalent.

Corequisite

None

Recommended Preparation

None

3. Catalog Description

First of a two**-**semester organic chemistry sequence. The topics covered will include nomenclature of organic compounds, stereochemistry, reaction mechanisms, and the study of representative reactions for certain classes or organic compounds. The relationship of structure to properties, reactivity, and mechanism or reaction will be emphasized. Students will become familiar with organic structure and functional groups by performing organic reactions. These will include nucleophilic substitution, dehydration, and organic redox used to synthesize new compounds from starting materials. Students will become proficient at separation and purification techniques including TLC, column chromatography, recrystallizations and distillations. They will also utilize a variety of instrumentation including NMR, FTIR spectroscopy, gas chromatography, UV spectroscopy, and HPLC. This course is intended for biology, chemistry and pre-medical majors needing either one or two semesters of organic chemistry.

4. Course Objectives

The student will:

1. Distinguish among the numerous classes of carbon compounds and predict their properties and reactivity.
2. Deduce the structures of the constitutional isomers corresponding to a given molecular formula.
3. Write a systematic name for an organic compound given its structure and vice-versa.
4. Deduce the principal conformations of open chain molecules and cyclohexane derivatives and determine their relative potential energies.
5. Deduce the structures of the stereoisomers possible for molecules with stereogenic centers.
6. Predict the operative mechanisms and the structures of the products in nucleophilic substitution, elimination, electrophilic addition, nucleophilic addition, radical substitution and addition, oxidation, and reduction reactions.
7. Design the synthesis and identify intermediates for an organic compound requiring multiple reaction steps.
8. Determine the structure of molecules from their FTIR and NMR spectra.
9. Interpret GC/MS data to characterize the nature of product and by-products of synthesis reactions.
10. Synthesize and purify and characterize compounds using traditional chemistry procedures and modern instrumentation.
11. In the laboratory, determine physical properties of melting point, boiling point and refractive index of organic compounds.
12. In the laboratory, become adept with basic organic laboratory operations such as liquid-liquid extraction, gravity and vacuum filtration, and both simple and fractional distillation.
13. In the laboratory, prepare, separate and purify products of organic syntheses using techniques including TLC, column chromatography, HPLC and GC. recrystallizations and distillations
14. In the laboratory, perform simple qualitative tests for detection of the different types of functional groups on compounds.
15. In the laboratory, characterize compounds based on modern spectrometric data including FTIR, NMR and GC/MS.
16. Determine the structure of molecules from their FTIR and NMR spectra.
17. In the laboratory, use GC/MS data to further characterize the nature of product and by-products of synthesis reactions**.**

5. Instructional Facilities

a. Standard classroom and laboratory.

b. Smartcart.

c. Wall mounted Periodic Chart.

d. Laboratory classroom including but not limited to:

(1) Drying ovens.

(2) pH meters.

(3) Fume hoods.

(4) Hot plates.

(5) Magnetic stir plates.

(6) Triple beam balances.

(7) Analytical balances.

(8) Melting point apparati.

(9) Bunsen burners and microburners.

(10) IR spectrometer.

(11) UV-vis spectrometer.

(12) GC.

(13) Oil baths and resistance heaters.

(14) NMR

e. Individual student drawers including but not limited to:

(1) Kem-Kit (Kontes Company).

(2) Standard laboratory equipment including but not limited to beakers, Erlenmeyerflasks, graduated cylinders, filter flasks, Buchner funnels, glass funnels, pipets, test tubes, test tube racks, glass sample vials, drying tubes, and assorted scoopulas, stir rods and spatulas.

6. Special Materials Required of Student

1. Laboratory apron or jacket.
2. Scientific calculator with exponential and logarithmic functionality.
3. Approved safety glasses or goggles.
4. Molecular model kit.
5. Laboratory notebook

7. Course Content

a. Classes, properties and reactivity of organic compounds

1. Structures of all the possible constitutional isomers corresponding to a given molecular formula.
2. Nomenclature of organic functional groups and organic compounds.
3. Conformational analysis of aliphatic hydrocarbons and cyclohexane derivatives.
4. Stereochemistry of saturated, unsaturated, and cyclic hydrocarbons.
5. Nucleophilic substitution, elimination and radical reactions and their mechanisms.
6. Synthesis, isolation, purification and characterization of carbon compounds in the laboratory – using both traditional and modern instrumental techniques
7. Structure and function relationships will be investigated using modeling techniques which include model kits, Spartan molecular modeling software and chemdraw**.**
8. Use of a variety of laboratory instrumentation including but not limited to FTIR spectroscopy, gas chromatography, UV spectroscopy, and HPLC to characterize products.
9. Quantitative analysis of theoretical and percent yields, Rf values, enantiomeric excess and other pertinent calculations.

8. Method of Instruction

1. Lecturewith an emphasis on quantitative and qualitative problem solving.

b. Integration of appropriate web-based and computer audiovisual materials such as animations, PowerPoints, videos, and other multimedia, silent and non-silent polls, group work, exit tickets, etc.

c. Computer assisted instruction.

d. Inquiry based laboratory experience.

9. Methods of Evaluating Student Performance

1. Written exams and final exam which may include fill-in-the-blank, short answer, multiple choice, and essay equations.
2. Laboratory reports such as descriptions and analysis of chemical reactions or analytical determinations as well as discussion of theory and analysis of sources of error.
3. Laboratory techniques to include proper safety procedures, use of laboratory equipment, and complete documentation of data.
4. Essays/presentations on topics such as experimental results, descriptive chemistry or current issues in chemistry.
5. Capstone project to demonstrate laboratory proficiency in experimental set-up, performing organic reactions, and isolating and characterizing the product using traditional and instrumental methods.
6. Homework and various assignments are used to teach an emphasize content including, but not limited to reading tests, watching videos, solving problems out of the textbook or computer aided instructional exercises, surveys, peer review, discussions, etc.

10. Outside Class Assignments

1. Laboratory reports such as descriptions and analysis of chemical reactions or analytical determinations.
2. Essays/presentations on topics such as experimental results, descriptive chemistry or current issues in chemistry.
3. Homework, both text and computer based.

11. Representative Texts

1. Representative Text(s):

(1) Wade, L.G. *Organic Chemistry*. 9th ed Upper Saddle River, New Jersey: Pearson, 2016.

(2) Lehman, John W. *Multiscale Operational Organic Chemistry*.2nd ed. Upper Saddle River, New Jersey: Pearson, 2009.

1. Supplementary texts and workbooks:

None.

Addendum: Student Learning Outcomes

Upon completion of this course, our students will be able to do the following:

* 1. Demonstrate a working knowledge of the language of organic chemistry.
  2. Recognize the major functional groups of organic compounds.
  3. Predict the major products of chemical reactions of representative organic functional groups.
  4. Apply a theoretical approach to explain the chemical and physical behavior of organic compounds.
  5. Employ laboratory equipment and techniques to collect, analyze and evaluate experimental data.