**BARTON COMMUNITY COLLEGE**

##### **COURSE SYLLABUS**

1. **GENERAL COURSE INFORMATION**

Course Number: CHEM 1816

Course Title: Organic Chemistry II

Credit Hours: 5 Credit Hours

Prerequisites: 1814 Organic Chemistry I or equivalent with a C or better.

Division/Discipline: Academic Division/Chemistry

Course Description: This course is the second half of a two-semester course in organic chemistry and provides students with the knowledge of the physical and chemical properties of carbon compounds with emphasis on the mechanisms of organic reactions, the nomenclature of the compounds and methods of organic synthesis. This course is designed for those students who need a good understanding of organic chemistry.

1. **INSTRUCTOR INFORMATION**

## **COLLEGE POLICIES**

Students and faculty of Barton Community College constitute a special community engaged in the process of education. The College assumes that its students and faculty will demonstrate a code of personal honor that is based upon courtesy, integrity, common sense, and respect for others both within and outside the classroom.

Plagiarism on any academic endeavors at Barton Community College will not be tolerated. The student is responsible for learning the rules of, and avoiding instances of, intentional or unintentional plagiarism. Information about academic integrity is located in the Student Handbook.

The College reserves the right to suspend a student for conduct that is detrimental to the College's educational endeavors as outlined in the College catalog, Student Handbook, and College Policy & Procedure Manual. (Most up-to-date documents are available on the College webpage.)

Anyone seeking an accommodation under provisions of the Americans with Disabilities Act should notify Student Support Services via email at disabilityservices@bartonccc.edu.

## **COURSE AS VIEWED IN THE TOTAL CURRICULUM**

Organic Chemistry II is an approved general education course at BCC, which can be used to fulfill degree requirements as a breadth laboratory science course in the natural/physical science. In addition, it is required (or recommended) to be taken by students enrolled in Chemistry, Physical Science, Biological Sciences, Medical Lab Technician, and pre-professional programs (e.g. Pre Dentistry, Pre-Forestry, Pre-Medicine, Pre-Pharmacy, Pre-Wildlife, Pre-Chiropractic, Pre-Veterinarian, Pre-Engineering, etc.)

The transferability of this course varies among 4-year college and university programs. These requirements may change from time to time and without notification. **Therefore it shall be the student’s responsibility to obtain relevant information from intended transfer institution during his/her tenure at BCC to insure that he/she enrolls in the most appropriate set of courses for the transfer program.**

## **ASSESSMENT OF STUDENT LEARNING/COURSE OUTCOMES**

Barton Community College is committed to the assessment of student learning and to quality education. Assessment activities provide a means to develop an understanding of how students learn, what they know, and what they can do with their knowledge. Results from these various activities guide Barton, as a learning college, in finding ways to improve student learning.

Course Outcomes, Competencies, and Supplemental Competencies:

* 1. Identify organic molecules from characteristic spectroscopic methods.
     1. Explain the electromagnetic spectrum and identify the area of the spectrum used for each spectroscopic method used in organic chemistry.
     2. Interpret molecular structure based on the combination of IR, NMR, and MS data. Any combination of spectra may be used for structure elucidation.
     3. Apply details of spectra including characteristic absorbance due to functional groups, shielding, signal splitting, and shifting of signals.
  2. Explain the theory and application of radical reactions.
     1. Identify the conditions required for a radical reaction to initiate.
     2. Identify the initiation, propagation, and terminal reactions in a radical mechanism.
     3. Predict the products of a radical reaction.
     4. Define homolytic and heterolytic bond cleavage.
     5. Write the mechanism for halogenation of alkanes.
  3. Explain the behavior, structure, and reactivity of benzene and aromatic compounds
     1. Name benzene derivatives using common names and IUPAC nomenclature.
     2. Define aromatic, antiaromatic, and non-aromatic compounds by using Huckel’s Rule.
     3. Identify electron donating and withdrawing groups on a benzene ring.
     4. Identify and utilize ortho, meta, and para directing groups in product prediction.
     5. Write the mechanism for Electrophilic Aromatic substitution.
        1. Identify and utilize Friedel-Crafts Alkylation and Acylation in synthesis and product prediction.
        2. Utilize the Heck Reaction for synthesis and predict the products of the mechanism.
     6. Write the mechanism for Nucleophilic Aromatic Substitution.
  4. Identify and apply the rules of the reactions that occur at the alpha carbon of carbonyl compounds.
     1. Define enol and enolates.
     2. Write the mechanism of the halogenation at the alpha carbon.
     3. Identify when direct enolate alkylation is appropriate.
     4. Describe the conditions and mechanisms for malonic ester synthesis.
     5. Describe the four major carbonyl condensation reactions (optional).
  5. Apply the rules of nomenclature, recognize the structures and physical properties of carboxylic acids and the acidity of the O-H bond in carboxylic acids.
     1. Name carboxylic acids and their derivatives using IUPAC nomenclature.
     2. Identify physical and spectroscopic properties of carboxylic acids and their derivatives
     3. Identify the derivatives of organic acids.
     4. Relate lipids to carboxylic acid chemistry.
        1. Identify Fatty acids as carboxylic acids.
        2. Define the reactions with fatty acids like saponification.
        3. Identify waxes as carboxylic acid derivatives.
     5. Determine the stereochemistry and oxidation-reduction reaction products for carbonyl compounds.
     6. Predict the products of Nucleophilic Acyl Substitution reactions.
  6. Apply the rules of nomenclature, outline the synthesis, and identify the reactions of aldehydes and ketones.
     1. Name aldehydes and ketones using IUPAC nomenclature.
     2. Identify physical and spectroscopic properties of aldehydes and ketones.
     3. Utilize protecting groups in organic synthesis.
     4. Identify and draw keto-enol tautomers.
     5. Illustrate how ketones and aldehydes are synthesized from alcohols.
        1. Show how alcohols can be used to synthesize ketones and aldehydes.
     6. Define and identify hemiacetals, hemiketals, acetals, and ketals.
     7. Explain the Benedict’s reagent reaction with aldehydes.
        1. Explain the products of coupling reactions of Organocuprate reactions.
  7. Apply the rules of nomenclature, outline the synthesis for, and identify the reactions of amines.
     1. Name amines using IUPAC nomenclature.
     2. Identify physical and spectroscopic properties of amines.
     3. Write reactions to synthesize amines.
     4. Identify amines as bases and nucleophiles.
     5. Write the Hofmann Elimination reaction mechanism.
     6. Identify amino acids as both amines and carboxylic acids.
        1. Identify properties and reactivity of amino acids.
        2. Structure of Proteins
  8. Optional or Supplemental Topics
     1. Apply the rules of nomenclature, outline the synthesis for, and identify the reactions of carbohydrates.
        1. Name carbohydrates using common and IUPAC nomenclature.
        2. Define monosaccharide, disaccharide, and polysaccharides.
        3. Define reducing sugar.
        4. Demonstrate the reaction mechanism for the hydrolysis of a disaccharide into its monosaccharide units.
  9. Work in the laboratory in accordance with good laboratory practices
     1. Dress in an appropriate manner as to promote safety in the laboratory, wearing appropriate laboratory attire and goggles when anyone is working with chemicals in the laboratory.
     2. Follow written directions accurately.
     3. Work safely and effectively, using equipment and chemical carefully and correctly.
     4. Demonstrate use of required techniques.
     5. Dispose of waste products in a proper manner.
     6. Find and interpret the safety information on MSDS's for the chemicals used in a particular laboratory.
  10. Gather and record qualitative and quantitative data accurately
      1. Acquire data using appropriate lab ware.
      2. Make and record visual observations.
      3. Use computers, when appropriate, as data acquisition tools.
      4. List or describe experimental assumptions made and any deviations from the written experimental procedures.
  11. Handle and evaluate data in logical, productive, and meaningful ways
      1. Create notebooks and laboratory reports that are clear, understandable, and accurately represent the data collected.
      2. Correlate observations with chemical or physical processes.
      3. Carry out suitable calculations with quantitative data, recognizing when data and calculations are within a reasonable range.
      4. Use observations of experimental data to present relevant conclusions pertaining to the experimental procedure.
      5. Correlate laboratory work with principal topics in the Organic Chemistry II lecture by discussing the results obtained in the context of the competencies identified above in outcomes A-H.

1. **INSTRUCTOR'S EXPECTATIONS OF STUDENTS IN CLASS**

1. **TEXTBOOKS AND OTHER REQUIRED MATERIALS**

## **REFERENCES**

### **METHODS OF INSTRUCTION AND EVALUATION**

### Since laboratory activities are integral to the learning outcomes of this lab science course, students must pass the laboratory portion of the class in order to successfully complete (“pass”) the course.

### **ATTENDANCE REQUIREMENTS**

## **COURSE OUTLINE**