

**SOUTHEAST COMMUNITY COLLEGE  
DIVISION OF ARTS AND SCIENCES**

**Sciences**

**Revision Date: 07-01-24**

**I. CATALOG DESCRIPTION**

Course Number: CHEM2520  
Course Title: Organic Chemistry II  
Prerequisite(s): CHEM2510 with a C or higher  
Catalog Description: Continuation of CHEM 2510. Topics in this course include the structure and properties of carbon compounds; including nomenclature, stereochemistry and spectroscopy of alcohols, phenols, ethers, epoxides, aromatic compounds, aldehydes, ketones, carboxylic acids and their derivatives, and amines. Students registering for this course must also register for the laboratory component of the course.  
Credit Hours: 4.0  
Class Hours: 45  
Lab Hours: 30  
Total Contact Hours: 75

**II. COURSE OBJECTIVES:** *Course will cover:*

- A. Structure, properties, synthesis, and nomenclature of alcohols, phenols, ethers, epoxides, aromatic compounds, aldehydes, ketones, carboxylic acids & their derivatives, and amines.
- B. Illustration of reaction mechanisms.
- C. Multi-step synthesis.
- D. Free-radical reactions.
- E. Reactions of Carbonyl compounds.
- F. Organometallics.
- G. Conjugated & Aromatic Systems (includes kinetic vs. thermodynamic control, Diels-Alder reaction and Woodward-Hoffman rules/orbital symmetry).
- H. Electrophilic and Nucleophilic Aromatic Substitution reactions.
- I. Continuation of Substitution, Elimination & Addition reactions.
- J. Reactions of Nitrogen containing compounds
- K. Spectroscopic principles. (Includes topics of chemical shift, splitting pattern, integration, and structure elucidation based on spectroscopic data.) This includes direct or virtual use of IR and <sup>1</sup>H-NMR instrumentation and/or software.
- L. Laboratory experiments in the preparations, separation, purification and identifications of organic compounds.

**III. STUDENT LEARNING OUTCOMES AND GENERAL EDUCATION LEARNING OUTCOMES**

- A. Student Learning Outcomes: *Student will be able to:*
  - 1. Draw the valid chemical structures using correct nomenclature and propose workable reaction mechanisms based on the physical properties and chemical behaviors of organic compounds.
  - 2. Apply conceptual and mechanistic knowledge toward the synthesis of organic compounds.
  - 3. Understand the basic mechanistic steps involving organic reactions.
  - 4. Practice safe laboratory principles in the preparation of organic compounds.
  - 5. Determine structure of an organic compound using spectroscopic data.
  - 6. Illustrate the mechanism of reaction pathways using arrow pushing.

7. Explain and describe the factors that affect Electrophilic & Nucleophilic Aromatic Substitution reactions.
  8. Differentiate between aromatic, non-aromatic and anti-aromatic compounds.
  9. Apply knowledge of reactions with Carbonyl compounds as well as N-containing compounds.
  10. Describe conjugated systems.
- B. General Education Learning Outcomes**
1. GELO #2: Written Communication
    - Outcome: Comprehend, analyze, and evaluate a given text.
    - Outcome: Develop a focused thesis statement and write with a clear purpose, using relevant examples, claims, and evidence.
    - Outcome: Identify and evaluate evidence from a variety of printed, visual, and electronic sources.
    - Outcome: Use content and style appropriate to a given audience.
    - Outcome: Read and write in mechanically-sound, college-level English.
  2. GELO #3: Critical Thinking & Problem Solving
    - Outcome: Collect, identify, interpret and analyze data.
    - Outcome: Synthesize information to arrive at reasoned solutions to problems.
    - Outcome: Evaluate ideas presented in writing, media, speech, or artistic presentations.
    - Outcome: Evaluate the validity of arguments, alternatives, data, outcomes, and/or impacts of actions.
    - Outcome: Acquire and integrate knowledge and construct relationships across disciplines.
  3. GELO #5: Analytical, Quantitative, and Scientific Reasoning
    - Outcome: Apply mathematical and scientific methods to solve problems from an array of contexts and everyday situations.
    - Outcome: Understand and create logical arguments supported by quantitative and scientific evidence and communicate those arguments in a variety of formats.
    - Outcome: Effectively develop strategies, algorithms, or experiments (or performing experiments) to better describe the systems or to solve the problems.
    - Outcome: Manipulate formulas, data sets, graphs, tables, etc. in a way to produce a meaningful outcome.

**IV. CONTENT/TOPICAL OUTLINE (*course outline may provide more detailed information*)**

- A. Review Reactions of Arenes
  1. Electrophilic substitution
  2. Acylation and alkylation reactions
  3. Factors affecting reaction rate
  4. Reactions of polycyclic arenes
- B. Review Spectroscopy
  1. Principles of spectroscopy and the electromagnetic spectrum
  2. NMR
  3. IR
  4. UV/VIS
  5. Mass Spectroscopy
- C. Organometallic compounds
  1. Nomenclature
  2. Preparation and reactions of organometallics
  3. Transition metal organometallics.
  4. Use of catalysts

- 5. Olefin synthesis
- D. Alcohols, Diols, Thiols
  - 1. Preparation and reactions
  - 2. Biological oxidation of alcohols
  - 3. Cleavage of diols
  - 4. Spectroscopic analysis
- E. Ethers, Epoxides and Sulfides
  - 1. Nomenclature
  - 2. Physical and chemical properties of ethers
  - 3. Preparation and reactions
  - 4. Spectroscopic analysis
- F. Aldehydes and Ketones
  - 1. nomenclature
  - 2. Structure and bonding of the carbonyl group
  - 3. Physical and chemical properties
  - 4. Sources
  - 5. Preparation and reactions
  - 6. Acetal formation and use
  - 7. Reaction with amines
  - 8. Spectroscopic analysis
- G. Carboxylic Acids
  - 1. Nomenclature
  - 2. Structure and bonding
  - 3. Acidity of carboxylic acids
  - 4. Salts of carboxylic acids
  - 5. Sources
  - 6. Preparation and reactions
  - 7. Lactone preparation
  - 8. Spectroscopic analysis
- H. Carboxylic Derivatives
  - 1. Nomenclature
  - 2. Structure and bonding
  - 3. Physical and chemical properties
  - 4. Nucleophilic Acyl Substitution
  - 5. Preparation and reactions
  - 6. Spectroscopic analysis
- I. Enols and Enolates
  - 1. Mechanisms of enols and enolates
  - 2. Physical and chemical properties of study of enolates
  - 3. Preparation and reactions
  - 4. Haloform reactions
  - 5. Conjugation Effects in  $\alpha,\beta$ -unsaturated aldehydes and ketones
- J. Amines
  - 1. Nomenclature
  - 2. Structure, physical, and chemical properties
  - 3. Basicity Preparation and reactions
  - 4. Nitrosation reactions
  - 5. Azo Coupling
  - 6. Spectroscopic analysis
- K. Phenols
  - 1. Nomenclature
  - 2. Structure, physical and chemical properties

3. Acidity
4. Sources and naturally occurring
5. Preparation and reactions
6. Oxidation
7. Spectroscopic analysis
- L. Biological Compounds
  1. Carbohydrates
  2. Lipids
  3. Amino acids and proteins
  4. Nucleic acids

## V. INSTRUCTIONAL MATERIALS

- A. Required Text(s):
  1. Carey, Francis, A., Giuliano, Robert, M., *Organic Chemistry*, 12<sup>th</sup> Edition, McGraw Hill. ISBN: 9781264676590.
  2. Chem2520 Organic II Lab Manual
- B. Other Resources:
  1. Safety goggles,
  2. Scientific calculator.

## VI. METHODS OF PRESENTATION/INSTRUCTION

- A. Methods of presentation typically include a combination of the following:
  1. Lecture
  2. Discussion
  3. Demonstrations
  4. Small group activities
  5. Application
  6. On-Line
  7. Distance education
  8. Laboratory exercises

## VII. METHODS OF EVALUATION

- A. Methods of evaluation typically include a combination of the following:
  1. Participation
  2. Assignments
  3. Exams
  4. Projects
  5. Papers
  6. Lab work
- B. SCC GRADING SCALE
 

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|----|--------|----|-------|---|------------|
| A+ | 95-100 | C+ | 75-79 | F | 59 or less |
| A  | 90-94  | C  | 70-74 |   |            |
| B+ | 85-89  | D+ | 65-69 |   |            |
| B  | 80-84  | D  | 60-64 |   |            |

## VIII. SPECIFIC COURSE REQUIREMENTS

- A. Successful completion of CHEM2510 or equivalent.