

# CHEM-241: ORGANIC CHEMISTRY 2

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## Effective Term

Fall 2024

## CC Approval

03/17/2023

## AS Approval

04/11/2023

## BOT Approval

04/20/2023

## COCI Approval

03/05/2024

## SECTION A - Course Data Elements

### CB04 Credit Status

Credit - Degree Applicable

### Discipline

Minimum Qualifications

And/Or

Chemistry (Master's Degree)

### Subject Code

CHEM - Chemistry

### Course Number

241

### Department

Chemistry (CHEM)

### Division

Science and Engineering (SE)

### Full Course Title

Organic Chemistry 2

### Short Title

Organic Chemistry 2

### CB03 TOP Code

1905.00 - Chemistry, General

### CB08 Basic Skills Status

NBS - Not Basic Skills

### CB09 SAM Code

E - Non-Occupational

### Rationale

Our articulation officer and C-ID recommended we align our Organic Chemistry series with the state standards for TMC. This increases the units from 4 to 5 units for both Organic Chem 1 and 2 (total of 10 units). We are keen to align our courses with the state standard in preparation for the common course numbering system expected soon (AB 1111). Lastly, we would like to offer an AS-T in Chemistry which will be made possible by aligning with the TMC.

Additionally, we updated:

- The book edition to one published more recently.
- The DE modality of Hybrid.

## SECTION B - Course Description

### Catalog Course Description

A continuation of CHEM 240. Introduction to NMR, IR, and Mass Spectroscopy. Chemical reactions and syntheses of aromatic, carbonyl, and amine compounds. Special topics in carbohydrate, amino acid, and lipid chemistry. Lab work includes simple and multi-step syntheses and spectral identification.

## SECTION C - Conditions on Enrollment

### Open Entry/Open Exit

No

### Repeatability

Not Repeatable

### Grading Options

Letter Grade or Pass/No Pass

### Allow Audit

Yes

## Requisites

### Prerequisite(s)

Completion of CHEM-240 with a minimum grade of C.

## Requisite Justification

### Requisite Description

Course in a Sequence

### Subject

Chem

### Course #

240

### Level of Scrutiny

Required by 4-Year Institution

### Explanation

Before entering the second semester of Organic Chemistry, all CSU and UC (Including Sac State, UC Davis, and UC Berkeley) require completion of the first semester of Organic Chemistry. At NVC, the first semester of Organic Chemistry is Chem 240.

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## SECTION D - Course Standards

### Is this course variable unit?

No

### Units

5.00000

### Lecture Hours

54

### Lab Hours

108

### Outside of Class Hours

108

**Total Contact Hours**

162

**Total Student Hours**

270

**Distance Education Approval****Is this course offered through Distance Education?**

Yes

**Online Delivery Methods**

DE Modalities	Permanent or Emergency Only?
Hybrid	Permanent

**SECTION E - Course Content****Student Learning Outcomes****Upon satisfactory completion of the course, students will be able to:**

1. Communicate chemical and physical processes at the molecular level and how they relate to the macroscopic environment.
2. Solve synthetic reaction pathways and mechanisms while demonstrating the reasoning clearly and completely.
3. Implement laboratory techniques correctly using appropriate safety procedures and express them clearly in written laboratory reports.

**Course Objectives****Upon satisfactory completion of the course, students will be able to:**

1. Solve complex reaction mechanisms.
2. Synthesize compounds starting with simple ingredients.
3. Determine the structure of organic compounds from spectrographic data.
4. Name organic compounds based on their structure.

**Course Content****Lecture Content**

1. Spectroscopy
  - a. Nuclear Magnetic Resonance
  - b. Infrared Spectroscopy
  - c. Mass Spectrometry
2. Aromatics I: Aromaticity
  - a. Reactions of benzene, Kekules structure, stability, and modern theories of the structure for benzene.
  - b. Huckel's Rule and other aromatics.
  - c. Nomenclature of benzene derivatives.
  - d. Heterocyclic aromatics and aromatics in biochemistry.
3. Aromatics II: Reactions with Electrophiles
  - a. Electrophilic aromatic substitutions and their mechanisms.
  - b. Halogenation, nitration, sulfonation and alkylation of benzene.
  - c. Effects of substituents-reactivity and directing influences.
  - d. Alkyl and alkenyl benzenes and their reactions.
  - e. Carbenes.
4. Aldehydes and Ketones
  - a. Structure, nomenclature and physical properties.
  - b. Reactions of carbonyls - acetals, hemi-acetals, ammonia derivatives, and Schiff base reactons.
  - c. Keto-enol tautomerism, and the Cannizzaro Reaction.
5. Carboxylic Acids and their Derivatives
  - a. Nomenclature and physical properties.
  - b. Preparation and reactions at acyl carbon.

- c. Synthesis and reactions of acyl halides, acid anhydrides, esters and amides.
  - d. Hell-Volhard-Zelinski and decarboxylation reactions.
  - e. Claisen, Michael, and Aldol reactions and synthetic pathways.
6. Amines
- a. Nomenclature, physical properties and their basicities.
  - b. Some biologically important amines.
  - c. Preparation and reactions of amines with nitrous acid, diazonium salts.
  - d. The sulfa drugs.
  - e. Analysis of amines.
7. Carbohydrates
- a. Monosaccharides, mutarotation and glycoside formation.
  - b. Oxidation and reduction, osazone formation.
  - c. Synthesis and degradation of monosaccharides.
  - d. The D-family of aldoses.
  - e. Methylation of monosaccharides.
  - f. Di- and poly- saccharides.
  - g. Nitrogen containing sugars.
8. Lipids
- a. Fatty acids and Triacylglycerols.
  - b. Steroids and prostaglandins.
  - c. Phospholipids, waxes and terpenes.
9. Amino Acids and Proteins
- a. Important amino acids.
  - b. Laboratory synthesis and analysis of amino acids.
  - c. Amino acid sequence of proteins and polypeptides.
  - d. Primary structure of polypeptides and their synthesis.
  - e. Secondary and tertiary structure of proteins.

#### Lab Content

- 1. Methods of separation and purification
  - a. Simple and Fractional Distillation
  - b. Liquid-liquid extraction
  - c. Recrystallization
  - d. GC/TLC/Column Chromatography
- 2. Lab Techniques
  - a. Reflux columns
  - b. Gas Traps
  - c. Vacuum distillation
  - d. Air drying tubes
- 3. Spectroscopic Identification
  - a. FT-IR
  - b. NMR
  - c. GC-MS
- 4. Multistep syntheses
  - a. Synthesis of butyl methyl ether from butanol

Synthesis of Tylenol

## Methods of Instruction

### Methods of Instruction

Types	Examples of learning activities
Lab	Lab techniques are taught during a 4 hour lab period once per week.
Lecture	Students attend three hours of lecture per week.
Discussion	Two 1-hour short discussions on the weekly lab, lecture material, or Quiz
Experiments	Students are required to attend a four hour lab period where they do experiments in groups.

Observation and Demonstration

In-class demonstrations and online videos are shown to solidify and expand the lecture

### Instructor-Initiated Online Contact Types

E-mail Communication  
Video or Teleconferencing

### Student-Initiated Online Contact Types

Discussions  
Group Work

### Course design is accessible

Yes

## Methods of Evaluation

### Methods of Evaluation

Types	Examples of classroom assessments
Exams/Tests	Examinations (normally, four, including the final exam). Exams will be fill in, multiple choice, true/false, and short answer, and will be graded on a point scale. A sample question may be, "Given the NMR, IR, and Mass Spec provided, please draw the structure of the compound." or "What is the primary intermolecular bonding force in each of the following compounds?" or perhaps, "Explain how a triplet is formed in NMR."
Lab Activities	Regular attendance in the laboratory. All labs will be checked off by the instructor prior to the student leaving the lab.

## Assignments

### Reading Assignments

Daily reading of text; weekly reading of lab manual (ex: Read Chapter 2,"Bonding and Molecular Properties," Sections 2.1 through 2.4 in your text and read the first lab, "Simple and Fractional Distillations.")

### Writing Assignments

The students will be required to read assigned chapters in the text and lab manual. The students turn in weekly lab write-ups which are formatted according to Title, Procedure, Data, Calculations, Conclusions, and Sources of Error. End of chapter problems are assigned. Three exams and a final are given, and labs are graded. Each of these include essay and short answer solutions. A 5-10 page paper is due at the end of the semester.

## SECTION F - Textbooks and Instructional Materials

### Material Type

Textbook

### Author

K. Peter C. Vollhardt, Neil E. Schore

### Title

Organic Chemistry: Structure and Function

### Edition/Version

8th Edition

### Publisher

W. H. Freeman

### Year

2018

### Rationale

Book update from the previous edition

### ISBN #

1319079458

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**Material Type**

Manual

**Author**

S.E. Fawl

**Title**

Organic Chemistry 2 - Laboratory Manual

**Publisher**

Fountainhead Press

**Year**

2018

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**Proposed General Education/Transfer Agreement**

**Do you wish to propose this course for a Local General Education Area?**

No

**Do you wish to propose this course for a CSU General Education Area?**

No

**Do you wish to propose this course for a UC Transferable Course Agreement (UC-TCA)?**

No

**Course Codes (Admin Only)**

**CB00 State ID**

CCC000207712

**CB10 Cooperative Work Experience Status**

N - Is Not Part of a Cooperative Work Experience Education Program

**CB11 Course Classification Status**

Y - Credit Course

**CB13 Special Class Status**

N - The Course is Not an Approved Special Class

**CB23 Funding Agency Category**

Y - Not Applicable (Funding Not Used)

**CB24 Program Course Status**

Program Applicable

**Allow Pass/No Pass**

Yes

**Only Pass/No Pass**

No