

Washtenaw Community College Comprehensive Report

CEM 222 Organic Chemistry II Effective Term: Spring/Summer 2025

Course Cover

College: Math, Science and Engineering Tech

Division: Math, Science and Engineering Tech

Department: Chemistry

Discipline: Chemistry

Course Number: 222

Org Number: 12320

Full Course Title: Organic Chemistry II

Transcript Title: Organic Chemistry II

Is Consultation with other department(s) required: No

Publish in the Following: College Catalog , Time Schedule , Web Page

Reason for Submission: Three Year Review / Assessment Report

Change Information:

Other:

Rationale: Changes to make course more in-line with transfer institutions, SLO and objectives changed slightly so content is the same as the course at the transfer institution.

Proposed Start Semester: Fall 2024

Course Description: In this course, students will continue to learn nomenclature, stereochemistry, preparations, and mechanisms, as well as the reactions of biological and organic compounds. Students will develop reaction sequences that can be used to synthesize various organic compounds from given starting materials. In the laboratory, students will learn how to synthesize and isolate organic compounds, and how to characterize them using spectroscopic methods and other analytical techniques. This course is the second of a two-semester sequence.

Course Credit Hours

Variable hours: No

Credits: 4

Lecture Hours: Instructor: 45 **Student:** 45

Lab: Instructor: 45 **Student:** 45

Clinical: Instructor: 0 **Student:** 0

Total Contact Hours: Instructor: 90 **Student:** 90

Repeatable for Credit: NO

Grading Methods: Letter Grades

Audit

Are lectures, labs, or clinicals offered as separate sections?: NO (same sections)

College-Level Reading and Writing

College-level Reading & Writing

College-Level Math

Level 3

Requisites

Prerequisite

CEM 211 minimum grade "C"

General Education

MACRAO

MACRAO Science & Math

MACRAO Lab Science Course

General Education Area 4 - Natural Science

Assoc in Applied Sci - Area 4

Assoc in Science - Area 4

Assoc in Arts - Area 4

Michigan Transfer Agreement - MTA

MTA Lab Science

Request Course Transfer

Proposed For:

Eastern Michigan University

Ferris State University

Grand Valley State University

Michigan State University

Oakland University

University of Michigan

Wayne State University

Western Michigan University

Central Michigan University

Student Learning Outcomes

1. Classify and name organic compounds based on their organic and biological functional groups. Apply nomenclature rules to recognize correct chemical names and formulas.

Assessment 1

Assessment Tool: Outcome-related departmental exam questions

Assessment Date: Spring/Summer 2024

Assessment Cycle: Every Three Years

Course section(s)/other population: All

Number students to be assessed: All

How the assessment will be scored: Answer key

Standard of success to be used for this assessment: 70% of students will score 70% or higher.

Who will score and analyze the data: Department faculty

2. Recognize and apply spectroscopic data to organic structure analysis.

Assessment 1

Assessment Tool: Outcome-related departmental exam questions

Assessment Date: Spring/Summer 2024

Assessment Cycle: Every Three Years

Course section(s)/other population: All

Number students to be assessed: All

How the assessment will be scored: Answer key

Standard of success to be used for this assessment: 70% of students will score 70% or higher.

Who will score and analyze the data: Department faculty

3. Describe mechanisms of reactions: oxidation/reduction, nucleophilic addition, nucleophilic substitution, and carbonyl alpha-carbon.

Assessment 1

Assessment Tool: Outcome-related departmental exam

Assessment Date: Spring/Summer 2024

Assessment Cycle: Every Three Years

Course section(s)/other population: All

Number students to be assessed: All

How the assessment will be scored: Answer key

Standard of success to be used for this assessment: 70% of students will score 70% or higher.

Who will score and analyze the data: Department faculty

4. Develop reaction sequences that can be used to synthesize various organic products from given starting materials.

Assessment 1

Assessment Tool: Outcome-related departmental exam questions

Assessment Date: Spring/Summer 2024

Assessment Cycle: Every Two Years

Course section(s)/other population: All

Number students to be assessed: All

How the assessment will be scored: Answer key

Standard of success to be used for this assessment: 70% of students will score 70% or higher.

Who will score and analyze the data: Department faculty

5. Perform laboratory procedures related to the synthesis, isolation, and analysis of organic compounds, and gain hands-on experience with the instrumentation, equipment, and hazardous material procedures.

Assessment 1

Assessment Tool: Laboratory reports

Assessment Date: Spring/Summer 2024

Assessment Cycle: Every Three Years

Course section(s)/other population: All

Number students to be assessed: All

How the assessment will be scored: Departmentally-developed rubric.

Standard of success to be used for this assessment: 70% of the students will score 6 out of 9 or higher on the lab report.

Who will score and analyze the data: Department faculty

Course Objectives

1. Alcohols and phenols: Utilize proper nomenclature and show patterns of acidity.
2. Alcohols and phenols: Study reactions: a) Preparation via alkenes, alkyl halides, and carbonyl reduction; b) Alcohol oxidation.
3. Draw conclusions to overall structure and stereochemistry of reaction products.
4. Apply knowledge of reaction mechanisms to different reaction types.
5. Execute with Organometallic Compounds (Organomagnesium, Organolithium, organocuprate; and organozinc): 1) preparation; 2) reactivity; 3) chemistry with oxiranes and its derivatives and carbonyl compounds; 4) coupling reactions.
6. Oxygen and sulfur compounds: Identify and name the various compounds containing oxygen and sulfur: ether, crown ether, epoxides, thiols, sulfides, and disulfides.
7. Oxygen and sulfur compounds: Draw the products of their major reaction types.
8. Spectroscopy: Explain how the various types of spectroscopy work, including infrared (IR), mass spectrometry (MS), and nuclear magnetic resonance (NMR, including proton and carbon NMR).
9. Spectroscopy: Interpret spectral data and relate the data to molecular structure.
10. Spectroscopy: Predict spectral characteristics based on functional group.
11. Carbonyl compounds: Identify and name the carbonyl-containing compounds: aldehydes and ketones.
12. Carbonyl compounds: Predict the products of the major reaction types: synthesis, oxidation, reduction, and nucleophilic addition on the carbonyl group using carbon, oxygen, sulfur, nitrogen, and

- hydrogen as nucleophiles.
13. Carboxylic acids and their derivatives: Identify and name carboxylic acids and their derivatives: acid halides, anhydrides, esters, amides, and nitriles.
 14. Carboxylic acids and their derivatives: Show synthesis mechanisms for the carboxylic acids and each derivative.
 15. Carboxylic acids and their derivatives: Draw reaction mechanisms for the main reaction types, including nucleophilic acyl substitution of each derivative.
 16. Enols and Enolates: Draw the tautomerization reaction under acidic and basic conditions and understand the acidity of the alpha hydrogens.
 17. Enols and Enolates: Draw reaction mechanisms and predict major products of carbonyl alpha-substitution, and carbonyl condensation reactions.
 18. Organic bases - Amines: Identify and name amine-containing compounds.
 19. Organic bases - Amines: Show patterns of basicity.
 20. Organic bases - Amines: Show major reaction products.
 21. Biomolecules: Identify the different biomolecules: carbohydrates, lipids, and proteins.
 22. Biomolecules: Characterize each group, their structures, and chemistry in terms of oxidation and reduction.
 23. Laboratory: Observe laboratory safety procedures.
 24. Laboratory: Keep a laboratory journal.
 25. Laboratory: Manipulate laboratory equipment: hands-on experience with instrumentation; equipment; and hazardous materials procedures.
 26. Laboratory: Interpret and follow written procedures.
 27. Laboratory: Collect and measure data.
 28. Laboratory: Interpret and summarize data.
 29. Laboratory: Apply significant figures to measurements, calculations, and data analysis.
 30. Laboratory: Draw conclusions based on experimental results.

New Resources for Course

Course Textbooks/Resources

Textbooks
Manuals
Periodicals
Software

Equipment/Facilities

Level III classroom
Testing Center
Computer workstations/lab

Reviewer

Faculty Preparer:

Breege Concannon

Action

Faculty Preparer

Date

Apr 01, 2024

Department Chair/Area Director:

Breege Concannon

Recommend Approval

Apr 02, 2024

Dean:

Tracy Schwab

Recommend Approval

Apr 08, 2024

Curriculum Committee Chair:

Randy Van Wagnen

Recommend Approval

Apr 14, 2025

Assessment Committee Chair:

Jessica Hale

Recommend Approval

Apr 17, 2025

Vice President for Instruction:

Brandon Tucker

Approve

Apr 23, 2025

Washtenaw Community College Comprehensive Report

CEM 222 Organic Chemistry II Effective Term: Spring/Summer 2020

Course Cover

Division: Math, Science and Engineering Tech

Department: Physical Sciences

Discipline: Chemistry

Course Number: 222

Org Number: 12320

Full Course Title: Organic Chemistry II

Transcript Title: Organic Chemistry II

Is Consultation with other department(s) required: No

Publish in the Following: College Catalog , Time Schedule , Web Page

Reason for Submission: Three Year Review / Assessment Report

Change Information:

Consultation with all departments affected by this course is required.

Rationale: This is a required course review - no changes implemented.

Proposed Start Semester: Winter 2020

Course Description: This course is the second of a two-semester sequence. In this course, students will continue to learn nomenclature, stereochemistry, preparations, and reactions of organic compounds (aromatic compounds, organic oxygen and sulfur compounds, carbonyl compounds, carboxylic acids, amines) and biological compounds. Students will apply this knowledge by developing reaction sequences that can be used to synthesize various organic compounds from given starting materials. In the laboratory, students will learn how to synthesize and isolate organic compounds and then characterize them using spectroscopic methods.

Course Credit Hours

Variable hours: No

Credits: 4

Lecture Hours: Instructor: 45 **Student:** 45

Lab: Instructor: 45 **Student:** 45

Clinical: Instructor: 0 **Student:** 0

Total Contact Hours: Instructor: 90 **Student:** 90

Repeatable for Credit: NO

Grading Methods: Letter Grades

Audit

Are lectures, labs, or clinicals offered as separate sections?: NO (same sections)

College-Level Reading and Writing

College-level Reading & Writing

College-Level Math

Level 3

Requisites

Prerequisite

CEM 211 minimum grade "C"

General Education

MACRAO

MACRAO Science & Math

MACRAO Lab Science Course

General Education Area 4 - Natural Science

Assoc in Applied Sci - Area 4

Assoc in Science - Area 4

Assoc in Arts - Area 4

Michigan Transfer Agreement - MTA

MTA Lab Science

Request Course Transfer

Proposed For:

Central Michigan University

Eastern Michigan University

Ferris State University

Grand Valley State University

Michigan State University

Oakland University

University of Michigan

Wayne State University

Western Michigan University

Student Learning Outcomes

1. Classify and name organic compounds based on their organic and biological functional groups. Apply nomenclature rules to recognize correct chemical names and formulas.

Assessment 1

Assessment Tool: Departmental exam

Assessment Date: Spring/Summer 2022

Assessment Cycle: Every Three Years

Course section(s)/other population: All

Number students to be assessed: All

How the assessment will be scored: Answer key

Standard of success to be used for this assessment: 70% of students will score 75% or higher

Who will score and analyze the data: Department faculty

2. Recognize and apply spectroscopic data to organic structure analysis.

Assessment 1

Assessment Tool: Departmental exam

Assessment Date: Spring/Summer 2022

Assessment Cycle: Every Three Years

Course section(s)/other population: All

Number students to be assessed: All

How the assessment will be scored: Answer key

Standard of success to be used for this assessment: 70% of students will score 75% or higher.

Who will score and analyze the data: Department faculty

3. Perform laboratory procedures related to the synthesis, isolation, and analysis of organic compounds. Collect data, perform calculations and draw conclusions based on the results.

Assessment 1

Assessment Tool: Laboratory reports

Assessment Date: Spring/Summer 2022

Assessment Cycle: Every Three Years

Course section(s)/other population: All

Number students to be assessed: All

How the assessment will be scored: Departmentally-developed rubric

Standard of success to be used for this assessment: 70% of the students assessed will score 6 out of 9 or higher on the lab report.

Who will score and analyze the data: Department faculty

4. Complete reaction mechanisms with products and reaction conditions.

Assessment 1

Assessment Tool: Departmental exam

Assessment Date: Spring/Summer 2022

Assessment Cycle: Every Three Years

Course section(s)/other population: All

Number students to be assessed: All

How the assessment will be scored: Answer key

Standard of success to be used for this assessment: 70% of students will score 75% or higher.

Who will score and analyze the data: Department faculty

Course Objectives

1. Aromatic Compounds: Define aromaticity.
2. Aromatic Compounds: Draw the major product and reaction mechanism of electrophilic aromatic substitution reactions.
3. Aromatic Compounds: Predict the effects of substituents on reaction products and rate.
4. Aromatic Compounds: Show the major products of nucleophilic aromatic substitution and benzyne reaction types.
5. Spectroscopy: Explain how the various types of spectroscopy work, including infrared (IR), nuclear magnetic resonance (NMR), mass spectrometry and ultraviolet-visible (UV-Vis).
6. Spectroscopy: Interpret spectral data and relate the data to molecular structure.
7. Spectroscopy: Predict spectral characteristics based on functional group.
8. Oxygen and Sulfur Compounds: Identify and name the various compounds containing oxygen and sulfur: alcohols, ethers, epoxides, phenols, thiols, sulfides and disulfides.
9. Oxygen and Sulfur Compounds: Draw the products of their major reaction types.
10. Carbonyl Compounds: Identify and name the carbonyl-containing compounds: aldehyde and ketone.
11. Carbonyl Compounds: Predict the products of their major reaction types: synthesis, oxidation, reduction, condensation, and nucleophilic addition.
12. Carboxylic acids and their derivatives: Identify and name carboxylic acids and their derivatives: esters, acid halides, amides, anhydrides, and nitriles.
13. Carboxylic acids and their derivatives: Show synthesis mechanisms for each derivative.
14. Carboxylic acids and their derivatives: Draw reaction mechanisms for the main reaction types for each compound, including nucleophilic acyl substitution, carbonyl alpha-substitution, and carbonyl condensation reactions.
15. Organic bases - Amines: Identify and name amine-containing compounds.
16. Organic bases - Amines: Show patterns of basicity.
17. Organic bases - Amines: Show major reaction products.
18. Biomolecules: Identify the different biomolecules: carbohydrates, lipids, and proteins.
19. Biomolecules: Characterize each group and their functions.
20. Biomolecules: Relate stereochemistry to function.
21. Laboratory: Observe laboratory safety procedures.
22. Laboratory: Keep a journal.
23. Laboratory: Manipulate laboratory equipment.
24. Laboratory: Interpret and follow written procedures.
25. Laboratory: Collect and measure data, including spectroscopic techniques.
26. Laboratory: Interpret and summarize data.
27. Laboratory: Apply significant figures to measurements, calculations, and data analysis.

28. Laboratory: Draw conclusions based on experimental results.

New Resources for Course

Course Textbooks/Resources

Textbooks
Manuals
Periodicals
Software

Equipment/Facilities

Level III classroom
Testing Center
Computer workstations/lab

<u>Reviewer</u>	<u>Action</u>	<u>Date</u>
Faculty Preparer: <i>Nagash Clarke</i>	<i>Faculty Preparer</i>	<i>Aug 19, 2019</i>
Department Chair/Area Director: <i>Suzanne Albach</i>	<i>Recommend Approval</i>	<i>Aug 20, 2019</i>
Dean: <i>Victor Vega</i>	<i>Recommend Approval</i>	<i>Sep 17, 2019</i>
Curriculum Committee Chair: <i>Lisa Veasey</i>	<i>Recommend Approval</i>	<i>Sep 30, 2019</i>
Assessment Committee Chair: <i>Shawn Deron</i>	<i>Recommend Approval</i>	<i>Oct 04, 2019</i>
Vice President for Instruction: <i>Kimberly Hurns</i>	<i>Approve</i>	<i>Oct 07, 2019</i>

Washtenaw Community College Comprehensive Report

CEM 222 Organic Chemistry II

Effective Term: Winter 2018

Course Cover

Division: Math, Science and Engineering Tech

Department: Physical Sciences

Discipline: Chemistry

Course Number: 222

Org Number: 12320

Full Course Title: Organic Chemistry II

Transcript Title: Organic Chemistry II

Is Consultation with other department(s) required: No

Publish in the Following: College Catalog , Time Schedule , Web Page

Reason for Submission: Three Year Review / Assessment Report

Change Information:

Consultation with all departments affected by this course is required.

Course description

Outcomes/Assessment

Rationale: Regular three year review as a result of assessment report.

Proposed Start Semester: Winter 2018

Course Description: This course is the second of a two semester sequence. In this course, students will continue to learn nomenclature, stereochemistry, preparations, and reactions of organic compounds (aromatic compounds, organic oxygen and sulfur compounds, carbonyl compounds, carboxylic acids, amines) and biological compounds. Students will apply this knowledge by developing reaction sequences that can be used to synthesize various organic compounds from given starting materials. In the laboratory students will learn how to synthesize and isolate organic compounds and then characterize them using spectroscopic methods.

Course Credit Hours

Variable hours: No

Credits: 4

Lecture Hours: Instructor: 45 **Student:** 45

Lab: Instructor: 45 **Student:** 45

Clinical: Instructor: 0 **Student:** 0

Total Contact Hours: Instructor: 90 **Student:** 90

Repeatable for Credit: NO

Grading Methods: Letter Grades

Audit

Are lectures, labs, or clinicals offered as separate sections?: NO (same sections)

College-Level Reading and Writing

College-level Reading & Writing

College-Level Math

Level 3

Requisites

Prerequisite

CEM 211 minimum grade "C"

General Education

MACRAO

MACRAO Science & Math

MACRAO Lab Science Course

General Education Area 4 - Natural Science

Assoc in Applied Sci - Area 4

Assoc in Science - Area 4

Assoc in Arts - Area 4

Michigan Transfer Agreement - MTA

MTA Lab Science

Request Course Transfer

Proposed For:

Central Michigan University

Eastern Michigan University

Michigan State University

University of Michigan

Wayne State University

Western Michigan University

Student Learning Outcomes

1. Classify and name organic compounds based on their organic and biological functional groups, as well as apply nomenclature rules to recognize correct chemical names and formulas.

Assessment 1

Assessment Tool: Departmental exam

Assessment Date: Spring/Summer 2020

Assessment Cycle: Every Three Years

Course section(s)/other population: All

Number students to be assessed: All

How the assessment will be scored: Answer key

Standard of success to be used for this assessment: 70% of students will score 75% or higher

Who will score and analyze the data: Department faculty

2. Recognize and apply spectroscopic data to organic structure analysis.

Assessment 1

Assessment Tool: Departmental exam

Assessment Date: Spring/Summer 2020

Assessment Cycle: Every Three Years

Course section(s)/other population: All

Number students to be assessed: All

How the assessment will be scored: Answer key

Standard of success to be used for this assessment: 70% of students will score 75% or higher.

Who will score and analyze the data: Department faculty

3. Perform laboratory procedures related to the synthesis, isolation, and analysis of organic compounds.
Collect data, perform calculations and draw conclusions based on the results.

Assessment 1

Assessment Tool: Laboratory reports

Assessment Date: Spring/Summer 2020

Assessment Cycle: Every Three Years

Course section(s)/other population: All

Number students to be assessed: All

How the assessment will be scored: Departmentally-developed rubric

Standard of success to be used for this assessment: 70% of the students assessed will score 6 out of 9 or higher on the lab report.

Who will score and analyze the data: Department faculty

4. Complete reaction mechanisms with products, reaction conditions and any relevant stereochemistry.

Assessment 1

Assessment Tool: Departmental exam

Assessment Date: Spring/Summer 2020

Assessment Cycle: Every Three Years

Course section(s)/other population: All

Number students to be assessed: All

How the assessment will be scored: Answer key

Standard of success to be used for this assessment: 70% of students will score 75% or higher.

Who will score and analyze the data: Department faculty

Course Objectives

1. Aromatic Compounds: Define aromaticity.
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3. Aromatic Compounds: Predict the effects of substituents on reaction products and rate.
4. Aromatic Compounds: Show the major products of nucleophilic aromatic substitution and benzyne reaction types.
5. Spectroscopy: Explain how the various types of spectroscopy work, including, IR, NMR, Mass Spec and UV-Vis.
6. Spectroscopy: Interpret spectral data and relate to molecular structure.
7. Spectroscopy: Predict spectral characteristics based on functional group.
8. Oxygen and Sulfur Compounds: Identify and name the various oxygen and sulfur containing compounds: alcohols, ethers, epoxides, phenols, thiols, sulfides and disulfides.
9. Oxygen and Sulfur Compounds: Draw the products of their major reaction types.
10. Carbonyl Compounds: Identify and name the carbonyl containing compounds, aldehyde, and ketone.
11. Carbonyl Compounds: Predict the products of their major reaction types: synthesis, oxidation, reduction, condensation, and nucleophilic addition reaction types.
12. Carboxylic acids and their derivatives: Identify and name carboxylic acids and their derivatives: esters, acid halides, amides, anhydrides, and nitriles.
13. Carboxylic acids and their derivatives: Show synthesis mechanisms for each derivative.
14. Carboxylic acids and their derivatives: Draw reaction mechanisms for the main reaction types for each compound, including nucleophilic acyl substitution, carbonyl alpha-substitution, and carbonyl condensation reactions.
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19. Biomolecules: Characterize each group and their functions.
20. Biomolecules: Relate stereochemistry to function.
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22. Laboratory: Keep a journal.

- 23. Laboratory: Manipulate laboratory equipment.
- 24. Laboratory: Interpret and follow written procedures.
- 25. Laboratory: Collect and measure data, including spectroscopic techniques.
- 26. Laboratory: Interpret and summarize data.
- 27. Laboratory: Apply significant figures to measurements, calculations, and data analysis.
- 28. Laboratory: Draw conclusions based on experimental results.

New Resources for Course

Course Textbooks/Resources

- Textbooks
- Manuals
- Periodicals
- Software

Equipment/Facilities

- Level III classroom
- Testing Center
- Computer workstations/lab

<u>Reviewer</u>	<u>Action</u>	<u>Date</u>
Faculty Preparer: <i>Nagash Clarke</i>	<i>Faculty Preparer</i>	<i>Jul 19, 2017</i>
Department Chair/Area Director: <i>Kathleen Butcher</i>	<i>Recommend Approval</i>	<i>Aug 21, 2017</i>
Dean: <i>Kristin Good</i>	<i>Recommend Approval</i>	<i>Aug 23, 2017</i>
Curriculum Committee Chair: <i>Lisa Veasey</i>	<i>Recommend Approval</i>	<i>Oct 18, 2017</i>
Assessment Committee Chair: <i>Michelle Garey</i>	<i>Recommend Approval</i>	<i>Oct 31, 2017</i>
Vice President for Instruction: <i>Kimberly Hurns</i>	<i>Approve</i>	<i>Nov 06, 2017</i>