

CHEM R132: ORGANIC CHEMISTRY II

Originator

yma

College

Oxnard College

Discipline (CB01A)

CHEM - Chemistry

Course Number (CB01B)

R132

Course Title (CB02)

Organic Chemistry II

Banner/Short Title

Organic Chemistry II

Credit Type

Credit

Start Term

Fall 2021

Catalog Course Description

This course is the second half of the Organic Chemistry series with emphasis on oxygen-containing and nitrogen-containing organic substances, polymers, carbohydrates, proteins, lipids, and other biomolecules. The lab will involve multiple-step synthesis from smaller molecules to larger molecules.

Taxonomy of Programs (TOP) Code (CB03)

1905.00 - Chemistry, General

Course Credit Status (CB04)

D (Credit - Degree Applicable)

Course Transfer Status (CB05) (select one only)

A (Transferable to both UC and CSU)

Course Basic Skills Status (CB08)

N - The Course is Not a Basic Skills Course

SAM Priority Code (CB09)

E - Non-Occupational

Course Cooperative Work Experience Education Status (CB10)

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

Course Classification Status (CB11)

Y - Credit Course

Educational Assistance Class Instruction (Approved Special Class) (CB13)

N - The Course is Not an Approved Special Class

Course Prior to Transfer Level (CB21)

Y - Not Applicable

Course Noncredit Category (CB22)

Y - Credit Course

Funding Agency Category (CB23)

Y - Not Applicable (Funding Not Used)

Course Program Status (CB24)

1 - Program Applicable

General Education Status (CB25)

Y - Not Applicable

Support Course Status (CB26)

N - Course is not a support course

Field trips

May be required

Faculty notes on field trips; include possible destinations or other pertinent information

CSUCI, to use their analytical instruments.

Grading method

Letter Graded

Does this course require an instructional materials fee?

No

Repeatable for Credit

No

Is this course part of a family?

No

Units and Hours**Carnegie Unit Override**

No

In-Class**Lecture****Minimum Contact/In-Class Lecture Hours**

52.5

Maximum Contact/In-Class Lecture Hours

52.5

Activity**Laboratory****Minimum Contact/In-Class Laboratory Hours**

105

Maximum Contact/In-Class Laboratory Hours

105

Total in-Class**Total in-Class****Total Minimum Contact/In-Class Hours**

157.5

Total Maximum Contact/In-Class Hours

157.5

Outside-of-Class**Internship/Cooperative Work Experience**

Paid

Unpaid

Total Outside-of-Class**Total Outside-of-Class****Minimum Outside-of-Class Hours**

105

Maximum Outside-of-Class Hours

105

Total Student Learning**Total Student Learning****Total Minimum Student Learning Hours**

262.5

Total Maximum Student Learning Hours

262.5

Minimum Units (CB07)

5

Maximum Units (CB06)

5

Prerequisites

CHEM R130

Entrance Skills**Entrance Skills**

Ability to explain an organic reaction and give a reasonable mechanism.

Ability to utilize the fundamental organic lab techniques, such as use the melting point apparatus, set-up glassware for simple distillation, fractional distillation, steam distillation, extraction, and operate UV Spectrometry, IR Spectrometry, and polarimetry to conduct the multi-step organic synthesis.

Prerequisite Course Objectives

CHEM R130-Describe the products of organic reaction by applying basic principles learned in the course.

CHEM R130-Illustrate a suitable reaction pathway to a given product.

CHEM R130-Perform a multi-step synthesis of organic compounds in the laboratory.

CHEM R130-Classify the reactions as electrophilic addition, nucleophilic addition, nucleophilic substitution, elimination, or redox using the reaction mechanism.

CHEM R130-Name organic compounds using IUPAC (International Union of Pure and Applied Chemistry) nomenclature.

CHEM R130-Explain a reaction and give a reasonable mechanism for that reaction.

CHEM R130-Demonstrate the ability to use the library to find information related with certain organic substances.

CHEM R130-Discuss a specific reaction type of his/her choice by oral presentation or a five-page typed report.

CHEM R130-Establish two reactions leading to the same product and to indicate the one will be more likely to occur.

CHEM R130-Define structural details when given UV (Ultraviolet), IR (Infrared), NMR (Nuclear Magnetic Resonance), and mass spectrum data.

CHEM R130-Recognize isomers, such as conformational, constitutional, cis- and trans- or R- and S- isomers.

Requisite Justification**Requisite Type**

Prerequisite

Requisite

CHEMR130

Requisite Description

Course in a sequence

Level of Scrutiny/Justification

Content review

Student Learning Outcomes (CSLOs)**Upon satisfactory completion of the course, students will be able to:**

- | | |
|---|---|
| 1 | Illustrate a suitable reaction pathway to a given product. |
| 2 | Give IUPAC names for organic compounds: nomenclature worksheets related to alkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols, ethers, aldehydes, ketones, carboxylic acids, and their derivatives, amines, and amides. |
| 3 | Perform a multiple step synthesis in the laboratory to make larger molecules from smaller molecules. |
| 4 | Define structural details when given the spectra of UV (Ultraviolet), IR (Infrared), NMR (Nuclear Magnetic Resonance), and Mass Spectrum data. |

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

- | | |
|----|--|
| 1 | Name oxygen-containing and nitrogen-containing organic compounds using IUPAC (International Union of Pure and Applied Chemistry) nomenclature. |
| 2 | Describe the major and minor products of organic reaction by applying basic principles learned in the course. |
| 3 | Illustrate a suitable reaction pathway to a given product. |
| 4 | Perform a multi-step synthesis in the laboratory to make a larger molecule from smaller molecules. |
| 5 | Classify a reaction into a specific type of the reactions. |
| 6 | Explain a reaction and give a reasonable mechanism for that reaction. |
| 7 | Demonstrate the ability to use the library to find information related with certain organic substances. |
| 8 | Make a five-minute oral presentation on specific reaction types of his/her choice (or a three-page typed report on same). |
| 9 | Establish two reactions leading to the same product and indicate the one that will be more likely to occur. |
| 10 | Define structural details when given UV (Ultraviolet), IR (Infrared), NMR (Nuclear Magnetic Resonance), and mass spectrum data. |

Course Content**Lecture/Course Content**

1. Alcohol and Phenol
 - a. Naming Alcohols and Phenols
 - b. Physical and Chemical Properties of Alcohols and Phenols
 - c. Spectroscopy of Alcohols and Phenols
2. Ethers and Epoxides; Thiols and Sulfides
 - a. Naming Ethers, Thiols, and Sulfides
 - b. The Williamson Ether Synthesis
 - c. Acidic Cleavage and Claisen Rearrangement of Ethers
 - d. Cyclic Ethers, Thiols and Sulfides
 - e. Spectroscopy of Ethers
3. Aldehydes and Ketones: Nucleophilic Addition Reactions
 - a. Naming Aldehydes and Ketones
 - b. Preparation of Aldehydes and Ketones
 - c. Nucleophilic Additions of Aldehydes and Ketones: Hydration, Cyanohydrin formation, Alcohol Formation, Imine and Enamine Formation, The Wolff-Kishner Reaction, Acetal Formation, The Witt Reaction
 - d. The Cannizzaro Reaction

- e. Conjugate Nucleophilic Addition to Alpha, Beta-Unsaturated Aldehydes and Ketones
- f. Spectroscopy of Aldehydes and Ketones
- 4. Carboxylic Acids and Nitriles
 - a. Naming Carboxylic Acids and Nitriles
 - b. Physical Properties of Carboxylic Acids and Nitriles
 - c. Chemical Reactions of Carboxylic Acids and Nitriles
 - d. Spectroscopy of Carboxylic Acid and Nitriles
- 5. Carboxylic Acid Derivatives and Nucleophilic Acyl Substitution Reaction
 - a. Naming Carboxylic Acid Derivatives
 - b. Nucleophilic Acyl Substitution Reaction
 - c. Chemistry of Acid Halides, Acid Anhydrides, Esters, Amides
 - d. Thioesters and Acyl Phosphates
 - e. Polyamides and Polyesters
 - f. Spectroscopy of Acid Derivatives
- 6. Carbonyl Alpha-Substitution Reaction
 - a. Keto-Enol Tautomerism
 - b. Reactivity of Enols: The Mechanism of Alpha-Substitution Reactions
 - c. Alpha Halogenation of Aldehydes and Ketones
 - d. Alpha Bromination of Carboxylic Acids: The Hell-Volhard-Zelinskii Reaction
 - e. Enolate Ion Formation
 - f. Alkylation of Enolate Ions
- 7. Carbonyl Condensation Reaction
 - a. Mechanism of Carbonyl Condensation Reactions
 - b. Carbonyl Condensation Reactions versus Alpha-Substitution Reactions
 - c. Dehydration of Aldol Products: Synthesis of Enones
 - d. Intermolecular Aldol Reactions
 - e. The Claisen Condensation and The Dieckmann Cyclization
 - f. The Michael Reaction
 - g. The Stork Enamine Reaction
 - h. The Robinson Annulation Reaction
- 8. Amines
 - a. Naming Amines
 - b. Basicity of Amines
 - c. Synthesis and Reactions of Amines
 - d. Reactions of Arylamines
 - e. Tetraalkylammonium Salts as Phase-Transfer Catalysts
 - f. Spectroscopy of Amines
- 9. Biomolecules: Carbohydrates
 - a. Classification of Carbohydrates
 - b. Fischer Projection and D, L-Sugars
 - c. Cyclic Structures of Monosaccharides: Hemiacetal Formation
 - d. Reactions of Monosaccharides
 - e. Disaccharides and Polysaccharides
 - f. Cell-surface Carbohydrates and Carbohydrate Vaccines
- 10. Biomolecules: Amino Acids, Peptides, and Proteins
 - a. Structure of Amino Acids
 - b. Enantioselective Synthesis of Amino Acids
 - c. Peptides and Proteins
 - d. Peptide Sequencing
 - e. Peptide Synthesis
 - f. Protein Structure and Enzymes
- 11. Biomolecules: Lipids
 - a. Waxes, Fats, and Oils
 - b. Soap
 - c. Phospholipids
 - d. Prostaglandins and Terpenoids
 - e. Biosynthesis of Terpenoids
 - f. Steroids

12. Biomolecules: Heterocycles and Nucleic Acids
 - a. Nucleic Acids and Nucleotides
 - b. Base Pairing in DNA: The Watson-Crick Model
 - c. Structure and synthesis of RNA
13. The Organic Chemistry of Metabolic Pathway
 - a. Catabolism of Carbohydrates
 - b. Catabolism of Fats
 - c. Catabolism of Proteins
14. Synthesis of Polymers
 - a. Chain-Growth Polymers
 - b. Stereochemistry of Polymerization: Ziegler-Natta Catalysts
 - c. Polymer Structure and Physical Properties of Polymers

Laboratory or Activity Content

1. Introduction, Recording Keeping, and Organic Laboratory Safety
2. Use of UV-Spectrophotometer to Determine the Relative Rates and Quantitative Measurement of Electrophilic Aromatic Bromination
3. Oxidation of Cyclododecanol to Cyclododecanone (Miniscale)
4. Synthesis and Mechanism of Arene and Alcohols
5. Base-Catalyzed Oxidation-Reduction of Aldehydes by the Cannizzaro Reaction (Miniscale)
6. Reduction of 9-Fluorenone (Microscale or Miniscale)
7. Identification and Analysis of:
 - a. Alcohol and Phenol
 - b. Aldehydes and Ketones
 - c. Carboxylic acids and Esters
 - d. Carbohydrates
8. Enzymatic Reduction of Methyl Acetoacetate and Measurement of Optical Activity by the Polarimeter
9. Preparation and Analysis* of:
 - a. Triphenylmethanol (Miniscale)
 - b. Benzoic Acid (Microscale)
 - c. Benzocaine (Miniscale)
 - d. Luminol (Microscale)
 - e. Chemiluminescence (Microscale)
 - f. Nylon-6,10
 - g. Aniline
 - h. Acetanilide
 - i. All products are characterized by infrared (IR) spectroscopy. When possible, product analysis is done by Gas Chromatography and Mass Spectrum, and a Nuclear Magnetic Resonance Spectrophotometer**.
 - j. **CSU Channel Islands Instruments (Virtual Instrument Access Program)
10. Hydrolysis of Sucrose
11. Identification of Two to Three of Unknown Organic Compounds:
 - a. Preliminary Tests:
 - i. Physical Characteristics
 - ii. Solubility
 - iii. Acidity or Basic Properties
 - iv. Functional Group Analysis
 - v. Derivatization
 - b. Test for Aldehydes and Ketones:
 - i. 2,4-Dinitrophenylhydrazine
 - ii. Tollen's Test
 - iii. Chromic Acid Test
 - iv. Iodoform Test
 - c. Tests for Unsaturated Hydrocarbons:
 - i. Baeyer Test
 - ii. Bromine Test
 - d. Tests for Alkyl Halides:
 - i. Silver Nitrate
 - ii. Sodium Iodide
 - e. Tests for Alcohols:

- i. Chromic Acid
- ii. Lucas Test
- f. Tests for Phenols:
 - i. Bromine Test
 - ii. Ferric Chloride Test
- g. Instrumental Analysis:
 - i. Gas Chromatography and Mass Spectrometry
 - ii. Infrared (IR) Spectroscopy
 - iii. Nuclear Magnetic Resonance Spectroscopy-NMR (optional)

Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):

Problem solving exercises
 Skills demonstrations
 Written expression

Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):

Computational homework
 Essay exams
 Essays
 Group projects
 Individual projects
 Journals
 Laboratory activities
 Laboratory reports
 Oral analysis/critiques
 Objective exams
 Oral presentations
 Projects
 Problem-Solving Assignments
 Problem-solving exams
 Quizzes
 Reports/papers
 Research papers
 Skills demonstrations
 Simulations

Instructional Methodology

Specify the methods of instruction that may be employed in this course

Audio-visual presentations
 Computer-aided presentations
 Collaborative group work
 Class activities
 Class discussions
 Distance Education
 Demonstrations
 Group discussions
 Instructor-guided use of technology
 Internet research
 Laboratory activities
 Lecture
 Small group activities

Describe specific examples of the methods the instructor will use:

- The instructor will give the lecture and use the whiteboard to show The detailed mechanism with the oxygen-contained molecules.
- The instructor will illustrate the structures and reactions related to multi-step synthesis.
- The instructor may provide the links to the videos of the topic lecture or demonstration of lab techniques and some experiments to students for describing the patterns of reactions involving alcohols, aldehydes, ketones, and carboxylic acids.

Representative Course Assignments

Writing Assignments

1. Students will complete the assignments including structural drawing and IUPAC (International Union of Pure and Applied Chemistry) nomenclature of oxygen-containing and nitrogen-containing compounds.
2. Students will draw detailed mechanisms of different reactions.
3. Students may be required to write one term paper with the topics related to biosynthesis and metabolism of biomolecules.

Critical Thinking Assignments

- Students will use the spectrum data of the products to provide a reasonable mechanism that could cause the formation of by-products.
- The instructor will lead the discussion about "A Prologue to Metabolism" to apply the four fundamental carbonyl reactions on human metabolism.

Reading Assignments

1. Textbook and lab manual which include topics and experiments in organic chemistry.
2. Journals related with chemistry, diet, health care; such as Journal of Chemical and Engineering News, published by American Chemical Society; Popular Science
3. Internet; such as www.acs.org (<http://www.acs.org>), www.chemweb.com (<http://www.chemweb.com>), <http://ocw.mit.edu/OcwWeb/Chemistry/>, www.anytimetutor.com (<http://www.anytimetutor.com>)

Skills Demonstrations

Students should demonstrate safely perform the required chemistry experiments in an in-person lab, such as:

- masterly operate a melting point apparatus to measure the melting points of different organic compounds;
- safely transfer organic compounds under the fume hood;
- masterly set-up glassware for simple distillation, fractional distillation, and steam distillation;
- skillfully perfume multi-step extraction to purify products;
- masterly operate the instrument, such as UV, IR, and Polarimeter, in a chemistry lab;
- skillfully set-up and perform TLC and HPLC experiments to identify the different mixtures;
- properly use the chemical tests and data from the instruments to identify unknown organic molecules;
- safely conduct a multi-step synthesis to produce a designed molecule.

Other assignments (if applicable)

- Encourage students to form a studying group to discuss the structures and names of alcohols, ethers, phenols, aldehydes, ketones, carboxylic acids, carboxylic derivatives, amines, and amides.
- Propose a reasonable mechanism for possible by-products in an organic synthesis reaction.
- Help students individually in the instructor's office to show the detail of reaction mechanisms.

Outside Assignments

Representative Outside Assignments

- Students will be required to complete weekly homework and reading assignments from the textbook or other related materials.
- Students may be required to search the internet to write an essay/discussion with the topics related to their study. The topics of the essay/discussion reflect the discovery in the new vaccines, new drugs, and the application of new technology in chemistry fields.

Articulation

Comparable Courses within the VCCCD

CHEM V12B - General Organic Chemistry II

District General Education**A. Natural Sciences****B. Social and Behavioral Sciences****C. Humanities****D. Language and Rationality****E. Health and Physical Education/Kinesiology****F. Ethnic Studies/Gender Studies****CSU GE-Breadth****Area A: English Language Communication and Critical Thinking****Area B: Scientific Inquiry and Quantitative Reasoning****Area C: Arts and Humanities****Area D: Social Sciences****Area E: Lifelong Learning and Self-Development****Area F: Ethnic Studies****CSU Graduation Requirement in U.S. History, Constitution and American Ideals:****IGETC****Area 1: English Communication****Area 2A: Mathematical Concepts & Quantitative Reasoning****Area 3: Arts and Humanities****Area 4: Social and Behavioral Sciences****Area 5: Physical and Biological Sciences****Area 6: Languages Other than English (LOTE)****Textbooks and Lab Manuals****Resource Type**

Textbook

DescriptionJohn McMurry. *Organic Chemistry*. (2016 or latest edition) Cengage Learning. Boston, MA. USA**Resource Type**

Textbook

DescriptionJohn C. Gilbert Stephen F. Martin. *Experimental Organic Chemistry-A Miniscale and Microscale Approach*. (2016 or latest edition) Cengage Learning. Boston, MA. USA**Resource Type**

Other Instructional Materials

Description

Safety goggles.

Resource Type

Other Instructional Materials

Description

Molecular model set.

Resource Type

Other Instructional Materials

Description

A box colored pens or pencils.

Resource Type

Other Instructional Materials

Description

Duplicated lab notebook.

Resource Type

Other Instructional Materials

Description

Scientific calculator.

Distance Education Addendum**Definitions****Distance Education Modalities**

Hybrid (51%–99% online)

Hybrid (1%–50% online)

100% online

Faculty Certifications

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.

Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.

Yes

Regular Effective/Substantive Contact

Hybrid (1%–50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Synchronous Dialog (e.g., online chat)	Synchronous through ConferZoom for the topics related to the course contents. The set-time will be published in the course schedule. The instructor may also provide a set time as office hours each week where she/he will be available for answering questions in live time.
Asynchronous Dialog (e.g., discussion board)	Asynchronous essay/discussion through Canvas related to the course contents. The instructor will use asynchronous discussion boards encourages all students to participate in various types of interaction and critical thinking. Other discussion boards may be used for Q&A and general class discussions by students and instructors to facilitate student success in the course. Except for the midterm and final exam, other course assessments will be conducted through at the asynchronous time, such as upload homework, take a quiz, or conduct simulation experiments.
E-mail	Email/Canvas LMS communication tools will be used frequently to converse with students, such as giving the feedback of uploaded homework and essay, clarifying course contents, reminding the upcoming class events, and regarding the issues related later homework, grades, absences, etc.
Face to Face (by student request; cannot be required)	The direct face-to-face contact time with the instructor will be during weekly class meetings in-person on campus, and the open office hours and times requested by a student in the ConferZoom. This time will provide students to discuss and ask questions about the material covered in the course or other concerns in the class, such as individual progress. Students will be on campus to perform some organic experiments using specific techniques and operate UV and IR instruments.
Telephone	Students may request telephone calls for immediate assistant such as registration and grades, etc.
Video Conferencing	Schedule video conferences through ConferZoom to answer the questions related to the course contents and homework, also lead the discussion. The instructor will encourage students to form a study group using other media to facilitate student-to-student interactions.
Other DE (e.g., recorded lectures)	The instructor may use a recorded lecture, video, cumulated notes, 3C media, and other external links to integrate with the course contents. ADA compliance will be upheld with Closed Captioning during the session or of the recorded session.

Hybrid (51%–99% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Asynchronous Dialog (e.g., discussion board)	Regular use of asynchronous discussion boards encourages various types of interaction and critical thinking skills among all course participants. Questions and topics posed will allow students to discuss, compare and contrast, identify, and analyze elements of the course outcomes. Students will be required to respond to one another with substantive comments with the intent of creating a dialog. Other discussion boards may be used for Q&A and general class discussion by students and instructor to facilitate student success and strengthen student learning outcomes.
E-mail	E-mail, class announcements and various learning management system tools such as "Message Students Who" and "Assignment Comments", will be used to regularly communicate with all students on matters such as clarification of class content, reminders of upcoming assignments and/or course responsibilities, to provide prompt feedback to students on coursework to facilitate student learning outcomes, or to increase the role of an individual educator in the academic lives of a student. Students will be given multiple ways to email instructor through both the learning management system inbox and faculty provided email accounts.

Face to Face (by student request; cannot be required)	The instructor will hold weekly, scheduled office hours either in person or via-web conferencing, for students to be able to meet and discuss course materials or individual progress. Students can request additional in-person or web conferencing meetings with faculty member as needed. Faculty may encourage online students to form "study groups" in person or online.
Other DE (e.g., recorded lectures)	Faculty will use a variety of ADA compliant tools and media integrated within the learning management system to help students reach SLO competency. Tools may include: <ul style="list-style-type: none"> • Recorded Lectures, Narrated Slides, Screencasts • Instructor created content • OC Online Library Resources • Canvas Peer Review Tool • Canvas Student Groups (Assignments, Discussions) • 3rd Party (Publisher) Tools (MyOpenMath) • Websites and Blogs • Multimedia (YouTube, Films on Demand, 3CMedia, Khan Academy, etc.)
Synchronous Dialog (e.g., online chat)	Instructor will provide a set time each week where they will be available for synchronous chat and be available in the discussion board and can answer questions in live time.
Video Conferencing	Video tools such as ConferZoom can be used to provide live synchronous or asynchronous sessions with students. ADA compliance will be upheld with Closed Captioning during the session or of the recorded session. Recordings of all live sessions will be made available within the LMS. Video Conferences will be used to facilitate SLOs and student-to-student group meetings will also be encouraged.
Telephone	Students can request for instructor to call or vice versa in order to answer one-on-one questions about course material or student progress.

100% online Modality:**Method of Instruction****Document typical activities or assignments for each method of instruction**

Asynchronous Dialog (e.g., discussion board)	Asynchronous sessions through Canvas related to the course contents. The instructor will use asynchronous discussion boards encourages all students to participate in various types of interaction and critical thinking. Other discussion boards may be used for Q&A and general class discussions by students and instructors to facilitate student success in the course. Except for the midterm and final exam, other course assessments will be conducted through at the asynchronous time, such as upload homework, take a quiz, or conduct simulation experiments.
E-mail	Email/Canvas LMS communication tools will be used frequently to converse with students, such as giving the feedback of uploaded homework and essay, clarifying course contents, reminding the upcoming class events, and regarding the issues related to later homework, grades, absences, etc.
Face to Face (by student request; cannot be required)	Face to face will be arranged through ConferZoom. The instructor will hold scheduled office hours for students to be able to meet and discuss course materials or individual progress. Students can request additional zoom meetings with the faculty member as needed. Faculty may encourage students to form "study groups" online.
Other DE (e.g., recorded lectures)	The instructor may use a recorded lecture, video, cumulated notes, 3C media, and other external links, such as YouTube, Films on Demand, Khan Academy, etc. to integrate with the course contents. The contents may provide the instructions of glassware set-up, operating common analytic instruments in organic labs, such as gas chromatography and infrared spectrometer, and interpreting the spectra of IR and NMR. ADA compliance will be upheld with Closed Captioning during the session or of the recorded session.

Synchronous Dialog (e.g., online chat)

Synchronous through ConferZoom for the topics related to the course contents. The set-time will be published in the course schedule. The instructor may also provide a set time as office hours each week where she/he will be available for answering questions in live time. The midterms and final exams will be conducted during the synchronous schedule time.

Telephone

Students may request the instructor to call or vice versa in order to answer one-on-one questions about course material or student progress or registration issues.

Video Conferencing

ConferZoom help sessions will be scheduled before or after synchronous time. The instructor may also encourage students to form a study group using video conferences to facilitate student-to-student interactions. Students may request extra asynchronous sessions for a group discussion to work on the class projects or experiment simulations.

Examinations

Hybrid (1%–50% online) Modality

Online
On campus

Hybrid (51%–99% online) Modality

Online
On campus

Primary Minimum Qualification

CHEMISTRY

Review and Approval Dates

Department Chair

09/02/2020

Dean

09/02/2020

Technical Review

09/09/2020

Curriculum Committee

09/09/2020

DTRW-I

MM/DD/YYYY

Curriculum Committee

11/25/2020

Board

MM/DD/YYYY

CCCCO

MM/DD/YYYY

Control Number

CCC000459303

DOE/accreditation approval date

MM/DD/YYYY