Cerro Coso College

Course Outline of Record Report

10/13/2021

CHEMC223 : Organic Chemistry II

General Information

Author:	• Alexander Gilewski • Burch, Andrew • Cameron, Scott
Course Code (CB01) :	CHEMC223
Course Title (CB02) :	Organic Chemistry II
Department:	Science
Proposal Start:	Spring 2022
TOP Code (CB03) :	(1905.00) Chemistry, General
SAM Code (CB09) :	Non-occupational
Distance Education Approved:	No
Course Control Number (CB00) :	CCC000203586
Curriculum Committee Approval Date:	11/03/2017
Board of Trustees Approval Date:	06/14/2012
External Review Approval Date:	12/31/1969
Course Description:	In this course, students learn about the chemistry of aromatic compounds, alcohols, thiols, ethers, epoxides and sulfides, aldehydes, ketones, carboxylic acids and carboxylic acid derivatives, amino acids, proteins, amines, phenols, carbohydrates, lipids, heterocycles, polymers, and biological systems. Pericyclic carbonyl condensation, alpha substitution, and other reaction mechanisms are also covered. This Organic Chemistry II course is taught according to the standards developed by the American Chemical Society.
Submission Type:	Mandatory Revision I've updated the Lab Outline to include recommended changes "multistep synthesis and analytical instrumentation are required".
Author:	• Alexander Gilewski

Faculty Minimum Qualifications

Master Discipline Preferred:	• Chemistry
Alternate Master Discipline Preferred:	• Chemistry
Bachelors or Associates Discipline Preferred:	No value
Additional Bachelors or Associates Discipline Preferred:	No value

Course Formerly Known As

Course Formerly Known As

No Value

Course Development Options

Basic Skills Status (CB08)

Course is not a basic skills course.

Course Special Class Status (CB13)

Course is not a special class.

Grade Options

- Letter Grade Methods
- Pass/No Pass

☐ Allow Students to Gain Credit by Exam/Challenge

Allowed Number of Retakes

0

Course Prior To College Level (CB21)

Not applicable.

Rationale For Credit By Exam/Challenge

No value

Retake Policy Description

Type:|Non-Repeatable Credit

☑ Allow Students To Audit Course

Course Support Course Status (CB26)

Course is not a support course

Associated Programs

☑ Course is part of a program (CB24)

Associated Program	Award Type	Active
CC General Sciences	A.A. Degree Major	Spring 2018
CC Liberal Arts: Mathematics & Science	A.A. Degree Major	Summer 2018 to Fall 2020
Liberal Arts: Mathematics & Science Associate in Arts Degree	A.A. Degree Major	Fall 2020

Transferability & Gen. Ed. Options

Course General Education Status (CB25)

Y

Transferability

Transferable to both UC and CSU

Transferability Status

Approved

C-ID	Categories	Status	Approval Date	Comparable Course
Chemistry	C-ID discipline	Approved	No value	CHEM 160S

Units and Hours

Summary

Minimum Credit Units (CB07)	5
Maximum Credit Units (CB06)	5
Total Course In-Class (Contact) Hours	126
Total Course Out-of-Class Hours	144
Total Student Learning Hours	270
Faculty Load	0

Credit / Non-Credit Options

Course Credit Status (CB04)

Credit - Degree Applicable

Course Non Credit Category (CB22)

Credit Course.

Non-Credit Characteristic

No Value

Course Classification Status (CB11)

Credit Course.

☐ Variable Credit Course

Funding Agency Category (CB23)

Not Applicable.

☐ Cooperative Work Experience Education Status (CB10)

Weekly Student Hours

	In Class	Out of Classs
Lecture Hours	4	8
Laboratory Hours	3	0
Activity Hours	0	0

Course Student Hours

Course Duration (Weeks)	18
Hours per unit divisor	54
Course In-Class (Contact) Hours	
Lecture	72
Laboratory	54
Activity	0
Total	126
Course Out-of-Class Hours	
Lecture	144
Laboratory	0
Activity	0
Total	144

Time Commitment Notes for Students

No value

Faculty Load

Extra Duties: 0

Faculty Load: 0

Units and Hours - Weekly Specialty Hours

Activity Name	Type	In Class	Out of Class
No Value	No Value	No Value	No Value

Pre-requisites, Co-requisites, Anti-requisites and Advisories

Prerequisite

CHEMC221 - Organic Chemistry I

Chemistry C221 provides students with skills such as relating the structure and reactivity of organic chemicals; concepts of mass spectrometry, infrared spectroscopy, ultraviolet-visible spectroscopy and nuclear magnetic resonance spectroscopy, as well as correlating the key attributes of the respective spectra from the chemical structure. Students will be able to safely perform hands-on laboratory experiments that involve analysis, purification and synthesis of organic compounds and to critically analyze and report the results of these experiments. Furthermore, The American Chemical Society Guidelines mandate that Organic Chemistry I be a prerequisite for Organic Chemistry II.

Entrance Skills

Entrance Skills	Description
No value	No value

Limitations on Enrollment

Limitations on Enrollment	Description
No value	No value

Specifications

Methods of Instruction

Methods of Instruction	Problem Solving
Rationale	Examples: homework, examinations, in-class problem solving.

Methods of Instruction	Written work
Rationale	Additional practice applying learned reactions to novel molecules or experimental conditions.

Methods of Instruction	Lecture
Rationale	Instructors disseminate informaiton on a topic to students for practice in application to organic molecules.

Methods of Instruction	Instruction through examination or quizzing
Rationale	To include both formative and summative assessments.

Methods of Instruction	Laboratory
Rationale	Students get hands-on experience in applying their knowledge of organic reactions.

Assignments

Out of class assignments may include but are not limited to

A. When conditions permit, a field trip to the China Lake NAWC Chemistry Division is undertaken in place of a laboratory experiment. Example: students are given a tour of the facility and are required to identify an 'unknown' organic chemical from analysis techniques such as infrared spectroscopy or nuclear magnetic resonance.

B. Homework assignments from the relevant chapter, including participation in the recitation session. Example: Students must solve problems deducing the structural formula of a compound containing an aldehyde group.

C. Written reports of the results from the laboratory experiments, including purpose, procedure, materials, identification of products, yield of products, and discussion of the results. Example: students must submit a laboratory report detailing the amounts of unsaturated acid (such as oleic acid) in olive oil.

D. Textbook Readings: students are expected to read each of the chapter in advance of the lecture. The chapters cover new material and are written at college-level English with many new technical terms, and must often be read more than once.

E. Background Research: as topics arise, students may need to perform background research and be ready to discuss in class. For example: new medicines and advanced batteries.

Methods of Evaluation	**Rationale**
Tests	Exams demonstrating the student's ability to analyze critically and apply concepts covered in the relevant chapters. Example: an exam problem requires students to demonstrate synthesis and reactivity of aldehydes and ketones using reaction mechanisms.
Homework	Homework assignments from the relevant chapter, including participation in the recitation session. Example: students must jointly solve the structural formula of the product of an Aldol condensation in the recitation sesssion.
Other	Laboratory Experiments that safely reinforce topics covered in lecture and also teach organic synthesis, purification, and analysis techniques, which test the student's ability to apply the concepts learned in class and to follow procedures in the laboratory manual, as well as to participate actively in the experiment. Example: The laboratory experiment "Martius Yellow" requires the students to synthesize, isolate and purify 6 organic compounds in a complex reaction scheme. This experiment is performed under a laboratory fume hood.

Other	American Chemical Society Standardized Exam in Organic Chemistry as the Final Exam Example: This standardized exam is a 2-hour 70 multiple choice question exam that covers topics listed in Organic Chemistry I and Organic Chemistry II.

Equipment

No Value

Textbooks

Author	Title	Publisher	Date	ISBN
Klein	Organic Chemistry	Wiley	2017	

Other Instructional Materials

Description	Manual:
Author	Williamson, H. Masters, K. M. (2017) Macroscale and Microscale Organic Experiments, Cengage
Citation	No value

Materials Fee

No

Learning Outcomes and Objectives

Course Objectives

No value

CSLOs

Analyze chemical structures by applying the concepts of structure and reactivity to all organic functional groups in order to propose viable synthetic routes to make various organic chemical compounds, including but not limited to: alcohols, ethers, aldehydes, ketones, carboxylic acid derivatives, carbonyl groups, amines, peptides, proteins, and synthetic polymers. Expected SLO Performance: 70.0

Apply the concepts of nucleophilic substitution, electrophilic substitution, carbocation mechanisms, carbanion mechanisms, resonance, elimination, stereochemistry, condensation reactions, and pericyclic reactions to provide accurate reaction mechanisms. Expected SLO Performance: 70.0

Provide the correct structures of organic chemicals from the respective mass spectrometry results, infrared spectra, utraviolet spectra, and nuclear magnetic resonance spectra, while identifying the key attributes of the respective spectra from the chemical structures. Expected SLO Performance: 70.0

Design and safely perform laboratory experiments that involve analysis, purification, and multi-step synthesis of organic compounds and to critically analyze and report the results of these experiments. Expected SLO Performance: 70.0

Analyze how the scientific method continues to be at the core of modern methodologies and experimental design. Expected SLO Performance: 70.0

Science Liberal Arts: Mathematics & Science AA Degree	Describe the nature of science, the methods applied in scientific investigations, and the value of those methods in developing a rigorous understanding of the physical world.

Communicate and analyze scientific results in writing, verbally and graphically. Expected SLO Performance: 70.0

Science Liberal Arts: Mathematics & Science AA Degree	Apply algebraic, graphical, numerical, and other methods to solve applied problems in the areas of mathematics, natural sciences, computer graphics, and computer animation.

Outline

Course Outline

A. Benzene and Aromaticity Review
1. Molecular Orbital Theory
2. Electrophilic Reactions
3. Other Aromatic Materials

B. Alcohols and Thiols
1. Structure of Alcohols and Thiols
2. Synthesis of Alcohols and Thiols
3. Reactions of Alcohols and Thiols
4. Spectroscopic Identification of Alcohols and Thiols

C. Ethers, Epoxides and Sulfides
1. Structure of Alcohols and Ethers, Epoxides and Sulfides
2. Synthesis of Alcohols and Ethers, Epoxides and Sulfides
3. Reactions of Alcohols and Ethers, Epoxides and Sulfides
4. Spectroscopic Identification of Ethers, Epoxides and Sulfides

D. Aldehydes and Ketones
1. Structure of Alcohols and Aldehydes and Ketones
2. Synthesis of Alcohols and Aldehydes and Ketones
3. Reactions of Alcohols and Aldehydes and Ketones
4. Spectroscopic Identification of Aldehydes and Ketones

E. Carboxylic Acid and Carboxylic Acid Derivatives
1. Structure of Alcohols and Carboxylic Acid and Carboxylic Acid Derivatives
2. Synthesis of Alcohols and Carboxylic Acid and Carboxylic Acid Derivatives
3. Reactions of Alcohols and Carboxylic Acid and Carboxylic Acid Derivatives
4. Spectroscopic Identification of Carboxylic Acid and Carboxylic Acid Derivatives

F. Carbonyl Condensations and Alpha Substitutions
1. Aldol Reactions
2. Claisen Reactions
3. Generalized Carbonyl Condensation Reactions and Alpha Substitutions

G. Amino Acids and Proteins
1. Structure
2. Synthesis
3. Stereochemistry
4. Reactions of Amino Acids

H. Aliphatic and Aromatic Amines and Phenols
1. Structure of Alcohols and Aliphatic and Aromatic Amines and Phenols
2. Synthesis of Alcohols and Aliphatic and Aromatic Amines and Phenols
3. Reactions of Alcohols and Aliphatic and Aromatic Amines and Phenols
4. Spectroscopic Identification of Aliphatic and Aromatic Amines and Phenols

I. Carbohydrates

1. Structure
2. Stereochemistry
3. Fischer Proof
4. Reactions of Carbohydrates

J. Lipids and Heterocycles
1. Structure
2. Synthesis
3. Stereochemistry
4. Reactions of Lipids
5. Reactions of Heterocycles
6. DNA

K. Polymers
1. Uses of Polymers
2. Polymer Synthesis
3. Polymer Growth Mechanisms
4. Specialty Polymers

L. Pericyclic Reactions
1. Diels-Alder
2. Symmetry Rules
3. Molecular Orbital Symmetry
4. General Rule for Pericyclic Reactions

M. Bioorganic Chemistry
1. Biological Systems
2. Organic Reactions in Biology
3. Energy Cycle Organic Chemistry

N. Analysis of Functional Groups
1. Infrared Spectroscopy
2. Nuclear Magnetic Resonance
3. Mass Spectrometry
4. UV/Visible Spectroscopy

Lab Outline

Hands-on laboratory experiments each to include at minimum:
1. Preparation of Reagents
2. Isolation and Purification
3. Analysis and Yield
4. Report Submission

The experiments performed in the laboratory portion of this course take place under the supervision of the instructor in a chemistry laboratory. Students expand upon their base knowledge of purification methods and gain experience in utilizing these techniques when applied to different compounds. The primary goal of the laboratory is for students to gain synthetic organic chemistry and analytical chemistry experience by conducting a variety of syntheses involving alcohols, carbonyl compounds, carboxylic acid derivatives, and aromatic substitutions. Synthesis of a target compound (such as 4-amino-1,2-naphthoquinone from napthol) involving at minimum five (5) synthetic steps with appropriate purification workups will be conducted over several weeks. Students will utilize appropriate analytical instrumentation (as UV-visible spectroscopy, infrared spectroscopy, melting point, nuclear magnetic resonance) to ensure synthetic success at each stage throughout the multistep synthesis. Students will also complete an extensive qualitative analysis of an unknown compound and determine its structure. Students will exercise appropriate safety considerations as applicable.

Experiments to be conducted:
- Fischer synthesis of fragrant esters
- Williamson ether synthesis
- Grignard synthesis of triphenylmethanol
- Multistep synthesis of 4-amino-1,2-naphthoquinone from napthol
- Aldol condensation of dibenzalacetone
- Robinson annulation
- Qualitative analysis

Delivery Methods

Delivery Method: Please list all that apply -Face to face -Online (purely online no face-to-face contact) -Online with some required face-to-face meetings (“Hybrid”) -Online course with on ground testing -iTV – Interactive video = Face to face course with significant required activities in a distance modality -Other

- Face to face
- Online with some required face-to-face meetings (“Hybrid”)

Rigor Statement: Assignments and evaluations should be of the same rigor as those used in the on-ground course. If they are not the same as those noted in the COR on the Methods of Evaluation and out-of-class assignments pages, indicate what the differences are and why they are being used. For instance, if labs, field trips, or site visits are required in the face to face section of this course, how will these requirements be met with the same rigor in the Distance Education section? Describe the ways in which instructor-student contact and student-student contact will be facilitated in the distance ed environments.

Distance education students will participate in class instruction activities (reading or viewing lecture materials, participating in discussions with fellow students and the instructor, and taking quizzes, exams, or other assessments) by spending an equivalent amount of hours per week similar to that in the traditional face-to-face classroom.
In the hybrid class, face-to-face interaction for difficult lecture concepts is possible, as are assessments. In iTV class, instruction will take place via the iTV system using similar or adapted lectures and demonstrations, and students will participate in class activities from their location using the iTV system.
Any hands-on exercises required for labs take the same amount of time and are of equal rigor online or onsite. All students, irrespectively of teaching modalities, complete equivalent amount of work.

Good practice requires both asynchronous and synchronous contact for effective contact. List the methods expected of all instructors teaching the course. -Learning Management System -Discussion Forums -Message -Other Contact -Chat/Instant Messaging -E-mail -Face-to-face meeting(s) -Newsgroup/Discussion Board -Proctored Exam -Telephone -iTV - Interactive Video -Other

- Discussion Forums
- Message
- Chat/Instant Messaging
- E-mail
- Face-to-face meeting(s)
- Proctored Exam

Software and Equipment: What additional software or hardware, if any, is required for this course purely because of its delivery mode? How is technical support to be provided?

N/A

Accessibility: Section 508 of the Rehabilitation Act requires access to the Federal government's electronic and information technology. The law covers all types of electronic and information technology in the Federal sector and is not limited to assistive technologies used by people with disabilities. It applies to all Federal agencies when they develop, procure, maintain, or use such technology. Federal agencies must ensure that this technology is accessible to employees and the public to the extent it does not pose an "undue burden". I am using -iTV—Interactive Video only -Learning management system -Publisher course with learning management system interface.

- Learning management system

Class Size: Good practice is that section size should be no greater in distance ed modes than in regular face-to-face versions of the course. Will the recommended section size be lower than in on-ground sections? If so, explain why.

No.

Emergency Distance Education Options The course will operate in remote delivery mode when all or part of the college service area is under an officially declared city, county, state, or federal state of emergency, including (check all that apply) - Online including all labs/activity hours - Hybrid with online lecture and onsite lab/activity hours - Correspondence education in high school and prison facilities - None. This course will be cancelled or paused if it cannot be held fully onsite.

- Online including all labs/activity hours