College of San Mateo
Official Course Outline

1. **COURSE ID:** CHEM 232 **TITLE:** Organic Chemistry II **C-ID:** CHEM 160S (CHEM 231 & CHEM 232)
   Units: 5.0 units **Hours/Semester:** 48.0-54.0 Lecture hours; 96.0-108.0 Lab hours; and 96.0-108.0 Homework hours
   Method of Grading: Letter Grade Only
   Prerequisite: CHEM 231

2. **COURSE DESIGNATION:**
   Degree Credit
   Transfer credit: CSU; UC
   AA/AS Degree Requirements:
   CSM - GENERAL EDUCATION REQUIREMENTS: E5a. Natural Science
   CSU GE:
   CSU GE Area B: SCIENTIFIC INQUIRY AND QUANTITATIVE REASONING: B1 - Physical Science
   CSU GE Area B: SCIENTIFIC INQUIRY AND QUANTITATIVE REASONING: B3 - Laboratory Activity
   IGETC:
   IGETC Area 5: PHYSICAL AND BIOLOGICAL SCIENCES: A: Physical Science
   IGETC Area 5: PHYSICAL AND BIOLOGICAL SCIENCES: C: Science Laboratory

3. **COURSE DESCRIPTIONS:**
   Catalog Description:
   More rigorous treatment of mechanisms, reactions and synthesis; structure determination using classical and spectroscopic techniques taught in Chem 231 including identification of unknown compounds and mixtures. Extra supplies may be required.

4. **STUDENT LEARNING OUTCOME(S) (SLO'S):**
   Upon successful completion of this course, a student will meet the following outcomes:
   1. Apply structure-reactivity principles to relate observable physical and chemical properties of organic molecules to their three-dimensional structures and polarities.
   2. Predict products of chemical reactions and propose a detailed reaction mechanism to explain the experimental results observed; extend these mechanisms by analogy to multi-step synthesis mechanisms.
   3. Use information from several sources and combine these data into a consistent model to determine structures of unknown molecules.
   4. Perform classical and modern analytical and purification techniques on more complex mixtures. Record the experimental observations in a logical order.

5. **SPECIFIC INSTRUCTIONAL OBJECTIVES:**
   Upon successful completion of this course, a student will be able to:
   1. Apply structure-reactivity principles to relate observable physical and chemical properties of organic molecules to their three-dimensional structures and polarities. Extend these principles to applications in related fields such as medicine and bioengineering.
   2. Predict products of chemical reactions and propose a detailed reaction mechanism to explain the experimental results observed; extend these mechanisms by analogy to similar systems.
   3. Use information from several sources and combine these data into a consistent model to determine structures of unknown molecules.
   4. Perform classical and modern analytical and purification techniques on more complex mixtures. Record the experimental observations in a logical order.

6. **COURSE CONTENT:**
   Lecture Content:
   1. Course Lecture:
      A. Reactions, reagents, and mechanisms: additional classes to be studied are aromatic hydrocarbons, aldehydes and ketones, amines, carboxylic acids and their derivatives, polyfunctional compounds, organometallic compounds including modern reducing agents and their properties; introduction to biomolecules. Modern analysis of compounds: NMR spectroscopy, IR spectroscopy; simple mass

spectral degradation patterns.

Lab Content:

- Laboratory
  1. Topic: Multistep synthesis using a range of synthesis, isolation, purification and characterization techniques.
     A. Students should be able to synthesis a series of organic compounds (benzaldehyde to benzoin, then benzil and then tetraphenylcyclopentadienone) while maintain yield over a multistep sequence.
  2. Topic: Advanced Synthetic reactions
     A. Coverage: Single or multi-step conversions from the standpoint of type of reaction and of effective performance. Examples to elucidate lecture material.
     B. Students should be able to understand the basis of, and carry out successfully, lab-manual type conversions and subsequent work-ups. Examples of experiments include Grignard reagents, Friedel-Craft Acylation and nitration of aromatic compounds, record the results in good order, possibly in format suitable for journal publication.
  3. Topic: Spectra
     A. Coverage: Further uses of IR and nmr spectra.
     B. Students should be able to interpret simple spectra, and deduce structure. Take IR spectra, interpret 1H nmr spectra with minimal instructor assistance.

TBA Hours Content:

There are no TBA hours for this course.

7. **REPRESENTATIVE METHODS OF INSTRUCTION:**

Typical methods of instruction may include:

A. Lecture
B. Activity
C. Discussion
D. Other (Specify): The course will include the following instructional methods as appropriate, in approximate order - Lecture format used to introduce new concepts and information; time will be provided to encourage student participation in question/answer period. - Theory, purpose, and practice of the lab experiment will be outlined by the instructor during the laboratory period. Students will perform experiments on an individual basis/ some experiments are class projects that require assigned student groups. - Class participation in the evaluation of data collected. - Where appropriate, selected topics will be complemented by multimedia resources.

8. **REPRESENTATIVE ASSIGNMENTS**

Representative assignments in this course may include, but are not limited to the following:

Writing Assignments:

End-of-Homework chapter questions which include both short answers and short-essay type answers. Tutorial questions which may include essay-type questions. Students are required to explain concepts and provide examples.

Laboratory reports. Students are taught to prepare lab reports to include title, objective, background information, procedure, results, data analysis and conclusion.

Reading Assignments:

Textbook-based reading to prepare for and support classroom learning.

Where appropriate, journal articles in either print or online format that supports content learning. For example: new developments in synthetic biology and discovery and development of novel materials such as graphene.

9. **REPRESENTATIVE METHODS OF EVALUATION**

Representative methods of evaluation may include:

A. Class Work
B. Exams/Tests
C. Homework
D. Lab Activities
E. Oral Presentation
F. Quizzes
G. Written examination

H. - Frequent exams covering two or three chapters of the text. (short questions, multipart questions, problem solving) - Regular end-of-chapter quizzes -Lab write-ups for each experiment, which include purpose, a detailed procedure, analysis of results, and answers to questions designed to elicit critical thinking. Some experiments are selected for more exhaustive treatment in a style appropriate for professional laboratory notebooks. For these write-ups, the student clarifies the purpose of the experiment, develops and rationalizes the experimental protocol, and justifies conclusions drawn from results.

10. **REPRESENTATIVE TEXT(S):**
Possible textbooks include:
A. McMurry. *Organic Chemistry*, 8th ed. Brooks Cole, 2014
B. -. *Study Guide for McMurry's Organic Chemistry*, 8th ed. Cengage Learning, 2014
C. Klein, D. *Organic Chemistry*, 2nd ed. Wiley, 2013
Other:
A. LABORATORY TEXT:
Pavia, Kriz, Lampman, Engel, Micro and Macro Techniques in the Organic Laboratory, Saunders College
B. Occasional topical articles assigned to maintain currency of lecture material.

Origination Date: October 2016
Curriculum Committee Approval Date: January 2017
Effective Term: Fall 2017
Course Originator: Catherine Ciesla