

COURSE IMPLEMENTATION DATE: { Sep-2003 }  
 COURSE REVISED IMPLEMENTATION DATE: { May-2006 }  
 COURSE TO BE REVIEWED: { Sep-2007 }  
 (FOUR (4) YEARS AFTER IMPLEMENTATION DATE) MONTH / YEAR

**OFFICIAL COURSE OUTLINE INFORMATION**

Students are advised to keep course outlines in personal files for future use.

Shaded headings are subject to change at the discretion of the department and material will vary - see course syllabus available from instructor.

FACULTY/DEPARTMENT: CHEMISTRY

CHEM 213

CHEM 211

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COURSE NAME/NUMBER

FORMER COURSE NUMBER

UCFV CREDITS

**ORGANIC CHEMISTRY I**

COURSE DESCRIPTIVE TITLE

**CALENDAR DESCRIPTION:**

Organic Chemistry I provides students with an introduction to the subject through a study of the characteristic reactions of the common functional groups. In this way, the chemistry of the alkanes, alkenes, alkynes are continued from first year. Alkyl halides, alcohols, aldehydes and ketones, carbohydrates and ethers are also discussed. Particular emphasis is placed on the study of reaction mechanisms, and the importance of stereochemistry is stressed throughout the course. The laboratory component of the course complements the lecture material and gives students experience in using some of the basic techniques that are employed in modern chemistry laboratories. This course is required for students pursuing careers in chemistry, biology, biochemistry, home economics, forestry, pre-medicine and pharmaceutical science.

**PREREQUISITES:** CHEMISTRY 113 and 114 or CHEMISTRY 111 and 112. Note: After April 2007, CHEM 101,102, 111, and 112 will no longer be accepted as prerequisites for this course.

**COREQUISITES:** NONE

**SYNONYMOUS COURSE(S)**

(a) Replaces: Chemistry 211  
(Course #)

(b) Cannot take: \_\_\_\_\_ for further credit  
(Course #)

**SERVICE COURSE TO:**

\_\_\_\_\_  
(Department / Program)

\_\_\_\_\_  
(Department / Program)

**TOTAL HOURS PER TERM:** 84

**STRUCTURE OF HOURS:**

Lectures: 46 hrs.  
 Seminar: \_\_\_\_\_ hrs.  
 Laboratory: 32 hrs.  
 Field Experience: \_\_\_\_\_ hrs.  
 Student Directed Learning: \_\_\_\_\_ hrs.  
 Other (Exams): 6 hrs.

Combination of Lecture and Lab Hours: \_\_\_\_\_ **YES/NO**

**TRAINING DAY-BASED INSTRUCTION**

**LENGTH OF COURSE:** \_\_\_\_\_ N/A

**HOURS PER DAY:** \_\_\_\_\_ N/A

**MAXIMUM ENROLMENT:** 24

**EXPECTED FREQUENCY OF COURSE OFFERING:** \_\_\_\_\_ at least once every year

**WILL TRANSFER CREDIT BE REQUESTED?:** (Lower-level courses only) YES X NO \_\_\_\_\_

**WILL TRANSFER CREDIT BE REQUESTED?:** (Upper-level requested by department) YES X NO \_\_\_\_\_

**TRANSFER CREDIT EXISTS IN BCCAT TRANSFER GUIDE:** YES \_\_\_\_\_ NO X

**AUTHORIZATION SIGNATURES:**

Course designer(s): Peter W. Slade, Arthur M. Last

Chairperson: \_\_\_\_\_  
(type name in this field)  
**(Curriculum Committee)**

Course reviewed by: \_\_\_\_\_  
(type name in this field)

Department Head: Noham Weinberg

Dean: Jackalyn Snodgrass

PAC Approval in Principle Date: \_\_\_\_\_  
(type date in this field)

PAC Final Approval Date: 07-Dec-05

CHEM 213

COURSE NAME / NUMBER

**LEARNING OBJECTIVES / GOALS / OUTCOMES / LEARNING OUTCOMES:**

Students enrolling in this course will be pursuing careers in chemistry or biology notably, but also other careers requiring a strong background in chemistry.

GENERAL: Students will understand the fundamental principles of organic chemistry.

SPECIFIC: It is intended that students will be able to:

1. Understand the basic principles underlying organic chemistry and apply them to new situations using a systematic and logical approach (e.g., in reaction syntheses).
2. Perform laboratory syntheses and analyses with care, precision and confidence.
3. Relate the information obtained in laboratory experimentation to the theoretical presentations in class sessions.
4. Appreciate the connection between organic syntheses and biological systems, where applicable.

**METHODS:**

Presentation of the course will be by inter-related class (theory) and laboratory sessions. Class sessions will promote active student participation to ensure continual mutual feedback in order to reinforce the learning process. Films and audio-visual aids will be used where appropriate. Problem assignments will be continually given. Some selected problems may be collected and marked.

**PRIOR LEARNING ASSESSMENT RECOGNITION (PLAR):**

Credit can be awarded for this course through PLAR

YES \_\_\_\_\_

NO   X  

**METHODS OF OBTAINING PLAR:**

Not applicable

**TEXTBOOKS, REFERENCES, MATERIALS:**

[Textbook selection varies by instructor. An example of texts for this course might be:]

**TEXTBOOK:** Organic Chemistry, 5th edition, John McMurry (Brooks/Cole)

UCFV Laboratory Manual for Chemistry 211 and 212

**REFERENCES:** Organic Chemistry, 4th edition, L.G. Wade Jr. (Prentice-Hall)

Organic Chemistry, 6th edition, Morrison and Boyd (Allyn and Bacon)

Organic Chemistry, 3rd edition, Fessenden & Fessenden (Brooks/Cole)

Organic Chemistry, 8th edition, T.W.G. Solomons and C. Fryhle (John Wiley & Sons)

**SUPPLIES / MATERIALS:**

Laboratory supplies required. Students are encouraged to purchase a set of molecular models.

**STUDENT EVALUATION:**

[An example of student evaluation for this course might be:]

This will be conducted under a flexible system guided by the following:

|                                     |     |
|-------------------------------------|-----|
| Laboratory (reports and techniques) | 25% |
| Tests and Assignments               | 75% |

**COURSE CONTENT:**

[Course content varies by instructor. An example of course content might be:]

Alkanes and Cycloalkanes: McM ch. 3 (3.6 - 3.8) ch 4 (4.4 - 4.15) 5.3, 10.3, 10.4

Reactions of alkanes: free radical chlorination and bromination: reactivity and selectivity, free radical stability. with mechanism using single barb arrows (fishhooks).

Natural sources of alkanes and the importance of the petroleum industry.

Cycloalkanes: nomenclature, stability of cycloalkanes, C<sub>3</sub>-C<sub>6</sub>: Baeyer ring strain theory, H data, orbital aspects, factors affecting stability. Conformations, particularly of cyclohexane and substituted cyclohexane, axial/equatorial positions, stereoisomerism, diaxial interactions, conformational analysis

Alkenes: McM ch 6 (6.11 - 6.12) ch 7 (7.3 - 7.10)

a) Structure and Synthesis: some done in 114. Review Synthesis by elimination reactions:

(i) dehydrohalogenation with related stereochemistry;

(ii) dehydration.

Synthesis by partial hydrogenation of an alkyne.

b) Reactions: Electrophilic addition and oxidation reactions

(H<sub>2</sub>, X<sub>2</sub>, HX, H<sub>2</sub>O, ROH, B<sub>2</sub>H<sub>6</sub>, KMnO<sub>4</sub>, O<sub>3</sub> epoxidation) (cont. on next page). Addition of radicals to alkenes: polymers - or introduction to terpenes.

Reaction mechanisms for hydrogenation, halogenation--Markovnikov and free radical, hydration, halohydrin, hydroboration, oxidation, epoxidation with stereochemical implications.

Applications of reactions to multi-step syntheses.

Alkynes: McM. ch. 8 (8.5 - 8.10)

Preparation by elimination. Reactions: electrophilic addition, oxidation as for alkenes; and substitution using terminal alkynes: S<sub>N</sub>2 vs. E2 aspects. Acidity of terminal alkynes. Use of alkynes with alkenes in multi-step syntheses

Stereoisomerism: McM. ch. 9 (9.5 - 9.12)

Structural and stereoisomerism - a review. Chirality, enantiomerism, optical activity

(including allenes), racemic modification, configuration (R, S nomenclature). Compounds with two chiral centres, meso, threo, erythro pairs. Three dimensional and Fischer structures. Stereochemistry of syn and anti addition to alkenes..

Conformations of disubstituted cycloalkanes. Resolution of an amine.

Alkyl Halides and Substitution/Elimination: McM. ch. 10 (10.4-10.10), ch. 11 (Sub. & Elim.) (11.10 - 11.16)

Nucleophilic substitution reactions (S<sub>N</sub>1, S<sub>N</sub>2), mechanisms, influence of changing R, Nu, L, solvent and temperature;

stereochemical aspects. Elimination reactions E2, E1 mechanisms, Zaitsev and Hofmann products, effect of R, Nu, L, solvent and temperature; stereochemical aspects. Substitution vs. Elimination summary. Reactions of chiral molecules, retention, inversion, racemization of configuration.

Alcohols: McM 10.8 - Grignards ch. 17 (omit 17.10, 17.11)

Preparation: S<sub>N</sub>2 attack, hydration, hydroboration, oxymercuration-demercuration, reduction of carbonyls, Grignard synthesis, diol formation. Reactions: oxidation, contrast of C-O and O-H bond strengths, dehydration, P<sub>X</sub><sub>3</sub>, tosylate, oxidation. Synthesis problems (Grignards). Use of alcohols in multi-step syntheses.

Aldehydes and Ketones: Nucleophilic addition reactions (McM pp 705-715); ch. 19 (omit 19.15, 19.17; 19.16 done previously).

(Review of) nomenclature.

Preparations (oxidation, reduction of acid chlorides, acylation). Reactions: oxidation; reduction; nucleophilic addition - Grignard, acetals, cyanohydrins; Cannizzaro reaction.

Carbohydrates: McM ch. 25.

Classification, particularly of the aldose series. Structures of monosaccharides (Fischer, Haworth, and chair forms, as applicable). Mutarotation. Di- and polysaccharides (sucrose, maltose, lactose, starch, cellulose), particularly their structures, linkages, and major properties. Reactions of aldoses and ketoses (particularly glucose and fructose) -oxidation, reduction, osazone formation, Kiliani-Fischer and Ruff reaction series. [If incomplete in 213, continue Carbohydrates in 214]

Ethers: McM 18.1-18.8

Nomenclature and structures. Preparation: substitution by alkoxy ions, Williamson synthesis, alkoxymercuration.

Reactions - cleavage by acid, use as solvents, epoxides - (recall trans diol formation in alkenes section) formation of epoxides and ring opening.

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**COURSE NAME / NUMBER**

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**LABORATORY EXPERIMENTS**

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To be selected from:

1. Distillation and the Purity of Liquids (Refractive Index)
  2. The Purity of Solids: Melting Point and Mixed Melting Point
  3. Purification of Solids by Crystallization
  4. Extraction
  5. Reactions of Carbonyls:
    - a) Qualitative Characterization of Aldehydes and Ketones
    - b) Identification by 2,4-dinitrophenyl hydrazone and Semicarbazone Derivatives
  6. Nucleophilic Substitution: Effect of Leaving Group on Adamantyl Halide Solvolysis
  7. Synthesis of an Alkene (cyclohexene, by Dehydration of Cyclohexanol)
  8. Synthesis of an Alkyl Halide (1-Bromobutane from n-Butanol)
  9. Gas Chromatography: Analysis of a Mixture of Alkenes
  10. Synthesis of an Alcohol (Triphenyl Methanol, via Grignard Reagent)
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