



CREDIT COURSE OUTLINE

I. COVER PAGE

(1) CHEM 29B	(2) ORGANIC CHEMISTRY LABORATORY II	(3) 2
Number	Title	Units

<table style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="3">(4) Lecture / Lab Hours:</td> </tr> <tr> <td colspan="3">Course Hours</td> </tr> <tr> <td style="width: 20%;">Weekly Lec hours:</td> <td style="width: 10%;"></td> <td style="width: 10%; text-align: center;">0</td> </tr> <tr> <td>Weekly Lab hours:</td> <td></td> <td style="text-align: center;">6.00</td> </tr> <tr> <td>Total Contact hours:</td> <td></td> <td style="text-align: center;">108.00</td> </tr> <tr> <td colspan="3">Lec will generate __ hour(s) outside work.</td> </tr> <tr> <td colspan="3">Lab will generate __ hour(s) outside work.</td> </tr> <tr> <td colspan="3">(5) Grading Basis:</td> </tr> <tr> <td>Grading Scale Only</td> <td></td> <td></td> </tr> <tr> <td>Pass/No Pass option</td> <td></td> <td style="text-align: center;">X</td> </tr> <tr> <td>Pass/No Pass only</td> <td></td> <td></td> </tr> <tr> <td colspan="3">(6) Advisories:</td> </tr> <tr> <td colspan="3">• English 1A</td> </tr> <tr> <td colspan="3">(7) Pre-requisites (requires C grade or better):</td> </tr> <tr> <td colspan="3">• CHEM29A - Organic Laboratory I</td> </tr> <tr> <td colspan="3">Corequisites:</td> </tr> <tr> <td colspan="3">• CHEM28B - Organic Chemistry lecture</td> </tr> </table>	(4) Lecture / Lab Hours:			Course Hours			Weekly Lec hours:		0	Weekly Lab hours:		6.00	Total Contact hours:		108.00	Lec will generate __ hour(s) outside work.			Lab will generate __ hour(s) outside work.			(5) Grading Basis:			Grading Scale Only			Pass/No Pass option		X	Pass/No Pass only			(6) Advisories:			• English 1A			(7) Pre-requisites (requires C grade or better):			• CHEM29A - Organic Laboratory I			Corequisites:			• CHEM28B - Organic Chemistry lecture			<table style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="3">(8) Classification:</td> </tr> <tr> <td style="width: 20%;"></td> <td style="width: 20%;"></td> <td style="width: 20%;"></td> </tr> <tr> <td>Degree applicable:</td> <td></td> <td style="text-align: center;">X</td> </tr> <tr> <td>Non-degree applicable:</td> <td></td> <td></td> </tr> <tr> <td>Basic skills:</td> <td></td> <td></td> </tr> <tr> <td colspan="3">(9) RC Fulfills AS/AA degree requirement: (area)</td> </tr> <tr> <td colspan="3">General education category:</td> </tr> <tr> <td>Major:</td> <td colspan="2">Liberal Arts & Sciences - Natural Sciences</td> </tr> <tr> <td>Certificate of:</td> <td colspan="2"></td> </tr> <tr> <td>Certificate in:</td> <td colspan="2"></td> </tr> <tr> <td>(10) CSU</td> <td>Baccalaureate:</td> <td style="text-align: center;">X</td> </tr> <tr> <td colspan="2">(11) Repeatable: (A course may be repeated three times)</td> <td style="text-align: center;">0</td> </tr> <tr> <td colspan="3">(12) C-ID:</td> </tr> <tr> <td>Proposed Start Date:</td> <td></td> <td style="text-align: center;">Fall 2012</td> </tr> </table>	(8) Classification:						Degree applicable:		X	Non-degree applicable:			Basic skills:			(9) RC Fulfills AS/AA degree requirement: (area)			General education category:			Major:	Liberal Arts & Sciences - Natural Sciences		Certificate of:			Certificate in:			(10) CSU	Baccalaureate:	X	(11) Repeatable: (A course may be repeated three times)		0	(12) C-ID:			Proposed Start Date:		Fall 2012
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(12) Catalog Description:

This course provides a study of the properties and reactions of organic compounds such as esters, aldehydes, ketones and aromatics. Students will work hands on with instruments such as a melting point apparatus, a refractometer, a polarimeter, a gas chromatograph, an infrared spectrometer and a nuclear magnetic resonance spectrometer.

II. COURSE OUTCOMES:

(Specify the learning skills the student demonstrates through completing the course and link critical thinking skills to specific course content and objectives.)

Upon completion of this course, students will be able to:

- I. synthesize, isolate, and purify a variety of organic molecules, such as esters, aldehydes, ketones and aromatics, following instructions in a laboratory manual and adhering to safety protocols.
- II. analyze organic compounds using instrumentation such as gas chromatography, infrared spectrophotometry (IR), melting point apparatus, refractometry, polarimetry, and nuclear magnetic resonance spectroscopy (NMR).
- III. perform experiments on a variety of biomolecules such as carbohydrates, amino acids and lipids.

III. COURSE OBJECTIVES:

(Specify major objectives in terms of the observable knowledge and/or skills to be attained.)

In the process of completing this course, students will:

- I. synthesize aromatic organic compounds using the Friedel-Crafts reaction
- II. synthesize simple organic cyclic compounds using the Diels-Alder process.
- III. set up a variety of reactions to make carboxylic acids, such as hydrolysis of benzonitrile and side chain oxidations of alkyl benzenes.
- IV. set up the formation of an ester followed by its basic hydrolysis, its saponification.
- V. perform qualitative tests for aldehydes and ketones.
- VI. synthesize a simple dipeptide from amino acids.
- VII. prepare a soap and learn how detergents work.
- VIII. determine the degree of unsaturation in lipids and explain its meaning for the structure and physical behavior of lipid molecules.

IV. COURSE OUTLINE:

Lab Content:

Each of the following experiments will take 4-6 hours. Alternative experiments may be substituted.

A. Aromatic Reactions

- nitration of bromobenzene
- Friedel-Crafts alkylation: synthesis of 2,5-di-*t*-butyl-1,4-dimethoxybenzene
- nucleophilic aromatic substitution: synthesis of 2,5-dinitrophenylaniline
- oxidation of the side chain of an arene: synthesis of 2-chlorobenzoic acid from 2-chlorotoluene
- benzyne intermediate: synthesis of triptycene

B. Carboxylic acids and derivatives

- hydrolysis of benzonitrile
- synthesis of aspirin
- synthesis of isoamyl acetate
- imides: synthesis of *N*-phenylphthalimide
- saponification of an ester.

C. Aldehydes and Ketones

- qualitative tests
- oxidation of cyclohexanol to cyclohexanone
- reduction of cyclohexanone to cyclohexanol
- acetal formation: synthesis of 4,5-dimethyldioxolane

D. Carbanions and α,β -unsaturated carbonyls

- Aldol Condensations, synthesis of dibenzalacetone

E. Amines

- synthesis of acetanilide
- coupling of aromatic diazonium compounds: azo-dye formation

F. Synthesis of cyclic compounds

- Diels-Alder reaction: cycloalkenes from conjugated dienes

G. Polynuclear aromatics and heterocycles

- oxidation of 2-methylnaphthalene

H. Organometallics

- Ferrocene synthesis

I. Carbohydrates

- qualitative tests
- acid catalyzed hydrolysis of sucrose: a kinetic study.

J. Amino Acids and Proteins

- qualitative tests
- synthesis of a peptide

K. Lipids: fats, oils and steroids

- Hanus test: qualitative determination of unsaturation in lipids
- preparation and properties of a soap

V. APPROPRIATE READINGS

Reading assignments may include but are not limited to the following:

I. Sample Text Title:

1. Recommended - Pavia, D. L. *Intro to Organic Lab Techniques Microscale Approach*, ed. 3rd Brooks Cole, 2011,
2. Recommended - Svoronos, P., Sarlo, E., Kulawiec, R.J *Organic Chemistry Laboratory Manual*, ed. 2nd McGraw-Hill, 1997,

II. Other Readings

1. Recommended - McMurray, J. *Organic Chemistry with Biological Applications*, 2nd ed. Belmont, CA: Cengage, 2010, ISBN: 9780495391449.
2. Recommended - *Spectral Interpretation software and Specdemo*

___ Global or international materials or concepts are appropriately included in this course

___ Multicultural materials and concepts are appropriately included in this course

If either line is checked, write a paragraph indicating specifically how global/international and/or multicultural materials and concepts relate to content outline and/or readings.

VI. METHODS TO MEASURE STUDENT ACHIEVEMENT AND DETERMINE GRADES:

Students in this course will be graded in at least one of the following four categories. Please check those appropriate. A degree applicable course must have a minimum of one response in category A, B, or C.

A. Writing	
Check either 1 or 2 below	
X	1. Substantial writing assignments are required. Check the appropriate boxes below and provide a written description in the space provided.
	2. Substantial writing assignments are NOT required. If this box is checked leave this section blank. For degree applicable courses you must complete category B and/or C.
	a) essay exam(s)
	d) written homework
	b) term or other paper(s)
	e) reading reports
X	c) laboratory report(s)
	f) other (specify)

Required assignments may include but are not limited to the following:

Laboratory reports are turned in after each experiment. They include the purpose of the experiment, the reaction and reaction mechanism, the yield of the compound prepared, the purity, melting point and refractive index, a conclusion, and answers to assigned post-lab questions.

B. Problem Solving	
Computational or non-computational problem-solving demonstrations, including:	
	a) exam(s)
X	d) laboratory reports
	b) quizzes
	e) field work
X	c) homework problems
	f) other (specify):

Required assignments may include but are not limited to the following:

1. Each experiment is finalized with a lab report in which purpose, reactions and reaction mechanism, data, yield calculation, and a conclusion, a deduction of the experiment, are stated.

2. Three in-depth lab reports are completed and written as a research paper using internet resources, and organic chemistry text books.

C. Skill demonstrations, including:	
X	a) class performance(s)
	c) performance exams(s)
	b) field work
	d) other (specify)

Required assignments may include but are not limited to the following:

The student's performance in terms of safety, accuracy and efficiency are noted during the laboratory experiments and included in the grade for laboratory reports.

D. Objective examinations including:	
	a) multiple choice
	d) completion
	b) true/false
	e) other (specify):
	c) matching items

COURSE GRADE DETERMINATION:

Description/explanation: Based on the categories checked in A-D, it is the recommendation of the department that the instructor's grading methods fall within the following departmental guidelines; however, the final method of grading is still at the discretion of the individual instructor. The instructor's syllabus must reflect the criteria by which the student's grade has been determined. (A minimum of five (5) grades must be recorded on the final roster.)

If several methods to measure student achievement are used, indicate here the approximate weight or percentage each has in determining student final grades.

Individual lab reports 40% and extensive lab research papers 60%

Does Course Require Social Facilities? Yes: Organic laboratory facility with specialized glassware, additional faucets, adequate fume hoods, a gas chromatograph, infrared spectrometer, melting point apparatuses, refractometer, and a nuclear magnetic resonance spectrometer.

VII. EDUCATIONAL MATERIALS

For degree applicable courses, the adopted texts, as listed in the college bookstore, or instructor-prepared materials have been certified to contain college-level materials.

Validation Language Level (check where applicable):

College-Level Criteria Met

YES NO

Textbook	<u>X</u>	<u> </u>
Reference materials	<u>X</u>	<u> </u>
Instructor-prepared materials	<u>X</u>	<u> </u>
Audio-visual materials	<u>X</u>	<u> </u>

Indicate Method of evaluation:

Used readability formulae (grade level 10 or higher)	<u> </u>
Text is used in a college-level course	<u>X</u>
Used grading provided by publisher	<u> </u>
Other: (please explain; relate to Skills Levels)	<u> </u>

Computation Level (Eligible for MATH 101 level or higher where applicable)

X

Content

Breadth of ideas covered clearly meets college-level learning objectives of this course	<u>X</u>	<u> </u>
Presentation of content and/or exercises/projects: Requires a variety of problem-solving strategies including inductive and deductive reasoning.	<u>X</u>	<u> </u>
Requires independent thought and study	<u>X</u>	<u> </u>
Applies transferring knowledge and skills appropriately and efficiently to new situations or problems.	<u>X</u>	<u> </u>

List of Reading/Educational Materials

Recommended - Pavia, D. L. *Intro to Organic Lab Techniques Microscale Approach*, ed. 3rd Brooks Cole, 2011, ISBN: 9780495016304

Recommended - Svoronos, P., Sarlo, E., Kulawiec, R.J *Organic Chemistry Laboratory Manual*, ed. 2nd McGraw-Hill, 1997, ISBN: 9780697339232

Three laboratory experiments will be finalized with a formal research paper, and substantial background reading in journals, books and the internet is required.

Comments:

- This course requires special or additional library materials (list attached).
- Three laboratory experiments will be finalized with a formal research paper, and substantial background reading in journals, books and the internet is required.
- This course requires special facilities:
- Organic laboratory facility with specialized glassware, additional faucets, adequate fume hoods, a gas chromatograph, infrared spectrometer, melting point apparatuses, refractometer, and a nuclear magnetic resonance spectrometer.

Attached Files:

BASIC SKILLS ADVISORIES PAGE The skills listed are those needed for eligibility for English 125, 126, and Math 201. These skills are listed as the outcomes from English 252, 262, and Math 250. In the right hand column, list at least three major basic skills needed at the beginning of the target course and check off the corresponding basic skills listed at the left.

Check the appropriate spaces.

- Eligibility for Math 201 is advisory for the target course.
- Eligibility for English 126 is advisory for the target course.
- Eligibility for English 125 is advisory for the target course.

If the reviewers determine that an advisory or advisories in Basic Skills are all that are necessary for success in the target course, stop here, provide the required signatures, and forward this form to the department chair, the appropriate associate dean, and the curriculum committee.

REQUISITES

Corequisite -- CHEM 28B ORGANIC CHEMISTRY II

- | | |
|---|---|
| <ul style="list-style-type: none">• predict the products of reactions of aromatic compounds.• draw the reaction mechanism of an electrophilic aromatic substitution.• complete reactions involving the carbonyl functional group such as aldehydes, ketones and carboxylic acids.• recognize bio-molecules such as carbohydrates, lipids, amino acids, proteins and nucleic acids. | <ul style="list-style-type: none">• synthesize aromatic organic compounds using the Friedel-Crafts reaction• synthesize simple organic cyclic compounds using the Diels-Alder process.• set up a variety of reactions to make carboxylic acids, such as hydrolysis of benzonitrile and side chain oxidations of alkyl benzenes.• set up the formation of an ester followed by its basic hydrolysis, its saponification.• perform qualitative tests for aldehydes and ketones. |
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- prepare a soap and learn how detergents work.
- determine the degree of unsaturation in lipids and explain its meaning for the structure and physical behavior of lipid molecules.

ESTABLISHING PREREQUISITES OR COREQUISITES

Every prerequisite or corequisite requires content review plus justification of at least one of the seven kinds below. Prerequisite courses in communication and math outside of their disciplines require justification through statistical evidence. Kinds of justification that may establish a prerequisite are listed below.

Check one of the following that apply. Documentation may be attached.

Significant statistical evidence indicates that the absence of the prerequisite course is related to unsatisfactory performance in the target course.

Justification: Indicate how this is so.

The health or safety of the students in this course requires the prerequisite.

Justification: Indicate how this is so.

The prerequisite course is part of a sequence of courses within or across a discipline.

The prerequisite is required in order for the course to be accepted for transfer to the UC or CSU systems.

Justification: Indicate how this is so.

The prerequisite/corequisite is required by law or government regulations.

Explain or cite regulation numbers:

The safety or equipment operation skills learned in the prerequisite course are required for the successful or safe completion of this course.

Justification: Indicate how this is so.

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Three CSU/UC campuses require an equivalent prerequisite or corequisite for a course equivalent to the target course:

Justification:

Prerequisite -- CHEM 29A ORGANIC CHEMISTRY LABORATORY I

- read and follow instructions in an organic laboratory manual, safely handling organic chemicals and glassware with ground-glass joints.
- determine physical properties of organic compounds such as melting point and refractive index.
- synthesize simple organic compounds such as but not limited to cyclohexene, t-butylchloride, alcohols and acids.
- analyze organic molecules using a gas chromatograph and infrared spectrometer and interpret the spectra.

- synthesize aromatic organic compounds using the Friedel-Crafts reaction
- synthesize simple organic cyclic compounds using the Diels-Alder process.
- set up a variety of reactions to make carboxylic acids, such as hydrolysis of benzonitrile and side chain oxidations of alkyl benzenes.
- set up the formation of an ester followed by its basic hydrolysis, its saponification.
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Justification: Indicate how this is so.

Three CSU/UC campuses require an equivalent prerequisite or corequisite for a course equivalent to the target course:

Justification: Laboratory techniques and safety precautions taught in the first semester are needed for the health and safety of all the students. CHEM29A is a prerequisite for CHEM29B at FCC.

JUSTIFICATION OF LIMITATION ON ENROLLMENT

Enrollment in courses or blocks of courses may be limited based on performance, honors, or other performance based criteria. Be mindful of the disproportionate impact the limitation will have on specific groups of students. It is important to determine if the limitation will disproportionately keep under-represented students from enrolling in the course or block of courses.

Describe the reasons for limiting the enrollment.

Course Designator: CHEM 29B
Course Title(s): ORGANIC CHEMISTRY LABORATORY II
Rationale for Limiting Enrollment: 0