



## 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">Total Course Hours</td> </tr> <tr> <td style="width: 30%;">Total Lec hours:</td> <td style="width: 10%;"></td> <td style="width: 60%; text-align: center;">0</td> </tr> <tr> <td>Total 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 <u>0</u> hour(s) outside work.</td> </tr> <tr> <td colspan="3">Lab will generate <u>0</u> 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"><i>No defined advisories.</i></td> </tr> <tr> <td colspan="3">(7) Pre-requisites (requires C grade or better):</td> </tr> <tr> <td colspan="3">CHEM 1B</td> </tr> <tr> <td colspan="3">Corequisites:</td> </tr> <tr> <td colspan="3">CHEM 28B</td> </tr> </table>	(4) Lecture / Lab Hours:			Total Course Hours			Total Lec hours:		0	Total Lab hours:		6.00	Total Contact hours:		108.00	Lec will generate <u>0</u> hour(s) outside work.			Lab will generate <u>0</u> hour(s) outside work.			(5) Grading Basis:			Grading Scale Only			Pass/No Pass option		X	Pass/No Pass only			(6) Advisories:			<i>No defined advisories.</i>			(7) Pre-requisites (requires C grade or better):			CHEM 1B			Corequisites:			CHEM 28B			<table style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="3">(8) Classification:</td> </tr> <tr> <td style="width: 30%;"></td> <td style="width: 10%;"></td> <td style="width: 60%;"></td> </tr> <tr> <td></td> <td>Degree applicable:</td> <td style="text-align: center;">X</td> </tr> <tr> <td></td> <td>Non-degree applicable:</td> <td></td> </tr> <tr> <td></td> <td>Basic skills:</td> <td></td> </tr> <tr> <td>(9) RC</td> <td>Fulfills AS/AA degree requirement: (area)</td> <td></td> </tr> <tr> <td></td> <td>General education category:</td> <td></td> </tr> <tr> <td></td> <td>Major:</td> <td></td> </tr> <tr> <td></td> <td>Certificate of:</td> <td></td> </tr> <tr> <td></td> <td>Certificate in:</td> <td></td> </tr> <tr> <td>(10) CSU</td> <td>Baccalaureate:</td> <td style="text-align: center;">X</td> </tr> <tr> <td>(11) Repeatable: (A course may be repeated three times)</td> <td></td> <td style="text-align: center;">0</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:			Certificate of:			Certificate in:		(10) CSU	Baccalaureate:	X	(11) Repeatable: (A course may be repeated three times)		0
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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. learn how to synthesize aromatic organic compounds using the Friedel-Crafts reaction
- II. learn how to synthesize simple organic cyclic compounds using the Diels-Alder process.
- III. gain an understanding how to set up a variety of reactions to make carboxylic acids, such as hydrolysis of benzonitrile, side chain oxidations of alkyl benzenes.
- IV. set up the formation of an ester followed by its basic hydrolysis, its saponification.
- V. learn how to do qualitative tests for aldehydes and ketones.
- VI. gain an understanding how to make a simple di-peptide from amino acids.
- VII. prepare a soap and learn how detergents work.
- VIII. learn how to determine the degree of un-saturation in lipids and 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: Friedel Crafts Alkylations.
- B. Nitration of Bromobenzene.
- C. Synthesis of Triptycene.
- D. Hydrolysis of Benzonitrile.
- E. Synthesis of Aspirin.
- F. Synthesis of Isoamyl acetate
- G. Saponification of an Ester.
- H. Oxidation of Cyclohexanol
- I. Acetal Formation
- J. Qualitative Tests for Aldehydes and Ketones
- K. Aldol Condensations, Synthesis of Dibenzalacetone
- L. Formation of Acetanilide
- M. Azo-dye Formation
- O. Acid catalyzed Hydrolysis of Sucrose. Kinetic Study.
- P. Qualitative Tests for Carbohydrates
- Q. Synthesis of a Peptide
- R. Qualitative Tests for Amino Acids and Proteins
- S. Preparation and Properties of a Soap
- T. Qualitative Determination of Un-saturation in Lipids

**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. 1st Brooks Cole, 2007, ISBN: 9780495016304
2. Recommended - Svoronos, P., Sarlo, E., Kulawiec, R.J *Organic Chemistry Laboratory Manual*, ed. 2nd McGraw-Hill, 1997, ISBN: 9780697339232

## II. Other Readings

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

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.

<b>A. Writing</b>	
Check either 1 or 2 below	
X	<b>1. Substantial writing assignments are required. Check the appropriate boxes below and provide a written description in the space provided.</b>
	<b>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.</b>
	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>B. Problem Solving</b> Computational or non-computational problem-solving demonstrations, including:			
<input type="checkbox"/>	a) exam(s)	X	d) laboratory reports
<input type="checkbox"/>	b) quizzes	<input type="checkbox"/>	e) field work
X	c) homework problems	<input type="checkbox"/>	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.

<b>C. Skill demonstrations, including:</b>			
X	a) class performance(s)	<input type="checkbox"/>	c) performance exams(s)
<input type="checkbox"/>	b) field work	<input type="checkbox"/>	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.

<b>D. Objective examinations including:</b>			
<input type="checkbox"/>	a) multiple choice	<input type="checkbox"/>	d) completion
<input type="checkbox"/>	b) true/false	<input type="checkbox"/>	e) other (specify):
<input type="checkbox"/>	c) matching items	<input type="checkbox"/>	

**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 chemistry laboratory

Attached Files:

<b>BASIC SKILLS ADVISORIES PAGE</b> The skills listed are those needed for eligibility for English 125, 126, and Math 101. These skills are listed as the outcomes from English 252, 262, and Math 250. In the right hand column, list at least <u>three</u> 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. <input type="checkbox"/> Eligibility for Math 101 is advisory for the target course. <input type="checkbox"/> Eligibility for English 126 is advisory for the target course. <input type="checkbox"/> Eligibility for English 125 is advisory for the target course. <i>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.</i>

**CONTENT REVIEW**

**CHEM 28B ORGANIC CHEMISTRY II**

**CHEM 1B GENERAL CHEMISTRY AND QUALITATIVE ANALYSIS**

**REQUISITES****Corequisite -- CHEM 28B ORGANIC CHEMISTRY II**

- 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.

- learn how to synthesize aromatic organic compounds using the Friedel-Crafts reaction
- learn how to determine the degree of un-saturation in lipids and its meaning for the structure and physical behavior of lipid molecules.
- learn how to synthesize simple organic cyclic compounds using the Diels-Alder process.
- gain an understanding how to set up a variety of reactions to make carboxylic acids, such as hydrolysis of benzonitrile, side chain oxidations of alkyl benzenes.
- set up the formation of an ester followed by its basic hydrolysis, its saponification.
- learn how to do qualitative tests for aldehydes and ketones.
- gain an understanding how to make a simple di-peptide from amino acids.

**Subject Prerequisite -- CHEM 1B GENERAL CHEMISTRY AND QUALITATIVE ANALYSIS**

- Understand chemical kinetics and mechanisms;
- Understand and be able to solve chemical equilibrium questions including but not limited to acid/base and pH concepts;
- Demonstrate general chemistry skills in the laboratory including qualitative analysis.

- learn how to synthesize aromatic organic compounds using the Friedel-Crafts reaction
- learn how to synthesize simple organic cyclic compounds using the Diels-Alder process.
- set up the formation of an ester followed by its basic hydrolysis, its saponification.

**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.

1. \_\_\_ The prerequisite/corequisite is required by law or government regulations.  
Explain or cite regulation numbers:
2. \_\_\_ The health or safety of the students in this course requires the prerequisite.  
Justification: Indicate how this is so.
3. \_\_\_ 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.
4. \_\_\_ 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.
5. \_\_\_ Significant statistical evidence indicates that the absence of the prerequisite course is related to unsatisfactory performance in the target course.  
Justification: Cite the statistical evidence from the research.
6. \_\_\_ The prerequisite course is part of a sequence of courses within or across a discipline.
7.  Three CSU/UC campuses require an equivalent prerequisite or corequisite for a course equivalent to the target course:  
CSU Fresno CHEM129B CHEM128B Cal Poly SLO CHEM318 CHEM317 UC Berkeley CHEM112B CHEM112A