PALOMAR COLLEGE
COURSE OUTLINE OF RECORD FOR
DEGREE CREDIT COURSE

__X__ Transfer Course __X__ A.A. Degree applicable course
(check all that apply)

COURSE NUMBER AND TITLE: CHEM 221 – Organic Chemistry

UNIT VALUE: 5

MINIMUM NUMBER OF SEMESTER HOURS: 144

BASIC SKILLS REQUIREMENTS: Appropriate language and computational skills

ENTRANCE REQUIREMENTS

PREREQUISITE: A minimum grade of "C" in CHEM 220

COREQUISITE: None

RECOMMENDED PREPARATION: CHEM 115 and 115L

SCOPE OF COURSE:
Continuation of the integrated treatment of organic chemistry including electronic and orbital theory with applications to carbon bonding, stereo chemistry, resonance theory, and reaction mechanisms of both aliphatic and aromatic compounds. Strong emphasis on organic nomenclature, reactions, preparations, and synthesis of organic compounds. Laboratory: Techniques and theories involved in organic reactions and preparations, qualitative organic analysis, and instrumental methods.

SPECIFIC COURSE OBJECTIVES:
The successful student will:
1. Investigate experimentally and/or theoretically in order to determine the properties, specific sites of reaction.
2. Apply research-grade laboratory techniques.
3. Incorporate theoretical knowledge with laboratory techniques and research of the literature in order to perform an independent laboratory "mini-research" project.
4. Analyze readings, orally and in writing.
5. Relate writer's statements to historical/cultural contexts and personal contexts.
6. Evaluate critical positions in readings.

Critical thinking will be required of students in such assignments and activities as problem solving, written and oral analysis and evaluation of readings, in-class discussions of readings, lectures, comments, ideas, examination of connections between a writer's statements and historical/cultural contexts, including personal contexts; assessing and evaluating critical positions.

CONTENT IN TERMS OF SPECIFIC BODY OF KNOWLEDGE:
I. Spectroscopic methods of structure determination
   A. An introduction to the general concepts of spectroscopy
   B. An assessment of visible and ultraviolet spectroscopy

C. Comprehensive treatment of proton nuclear magnetic resonance and resonance and infrared spectroscopy

II. Phenols and aryl halides and nucleophilic aromatic substitution
- A. Structure, nomenclature, natural occurrence, and properties of phenols
- B. Synthesis of phenols and their reactions as acids
- C. Reactions involving the -OH group
- D. Phenol (benzene) ring reaction
- E. The Claisen rearrangement reaction
- F. Aryl halides involving nucleophilic aromatic substitution mechanisms

III. Organic oxidation and reduction reactions and organometallic compounds
- A. General concepts of oxidation and reduction states of organic compounds
- B. Preparation of alcohols by oxidation and reduction reactions
- C. Organometallic compounds, preparation and reactions of organolithium, and organomagnesium compounds
- D. Grignard synthesis of alcohol
- E. Dialkylcuprates and Corey-House synthesis

IV. Aldehydes and ketones
- A. Nomenclature and physical properties of aldehydes and ketones
- B. Synthesis of aldehydes and ketones
- C. Assessment of carbonyl functional group reactivity
- D. Addition reactions including water, alcohols, ammonia derivatives, cyanides, bisulfite, and ylides
- E. Organometallic reagent addition
- F. Chemical and spectroscopic analysis of aldehydes and ketones
- G. Reactions at the alpha carbon and aldol reactions
  1. Alpha hydrogen acidity
  2. Tautomerism, enols, enolate ions
  3. Aldol reactions to include enolate addition, crossed aldol, and aldol condensation-cyclization reactions
  4. Acid-catalyzed aldol condensations
  5. Additions to alpha, beta-unsaturated aldehydes and ketones

V. Carboxylic acids and their derivatives and nucleophilic substitution at acyl carbon
- A. Nomenclature and physical properties
- B. Preparation of carboxylic acids
- C. Substitution reactions at the acyl carbon to include synthesis of acylhalides, anhydrides, esters, and amides
- D. Alpha haloacids and Hell-Volhard-Zelinski reaction

VI. Amines
- A. Nomenclature and physical properties
- B. Basicity of amines and amine salts
- C. Some biologically important amines
- D. Preparation and reactions of amines
- E. Diazotization and replacement reactions of arene diazonium salts and coupling reactions
- F. Sulfonyl chloride reactions with amines and synthesis of sulfanilamide
- G. Analysis of amines
- H. Eliminations involving ammonium compounds and Hofmann and Cope reactions

VII. Beta-Dicarbonyl compounds, synthesis, and reactions
- A. Claisen condensation
- B. Acetoacetic ester synthesis
- C. Malonic ester synthesis
- D. The Knoevenagel condensation

E. The Mannich reaction
F. Reactions of active hydrogen compounds
G. Michael addition reactions

VIII. Topics of biochemistry
Time permitting, this area of study will include the chemistry-structure and selected synthesis and reactions of carbohydrates, lipids, amino acids and proteins. This material is not crucial to the students' proper mastery or organic chemistry at this level.

CHEM 221L LABORATORY EXPERIMENTS:
1. Nerolin II
2. Aldol condensation
3. Cannizzaro reaction
4. Esterification
5. Grignard reaction: phenylmagnesium bromide to benzoic acid
6. Independent projects

REQUIRED READING:
Wade, L.G., Jr. Organic Chemistry. 4th Ed. Upper Saddle River: Prentice Hall, 1999.

Boyajian, David. Experimental Organic Chemistry. 1st Ed. Oceanside: D.A. Boyajian,1998.

References: Weast, Robert, ed. Handbook of Chemistry and Physics. Bacon Raton: CRC Press.
Budavari, Susan, ed. The Merck Index. Whitehouse Station: Merck Corporation.

SUGGESTED READING:
Morrison, R.T. and R.N. Boyd. Organic Chemistry. 4th Ed. Boston: Allyn and Bacon, 1983.

Allinger, M., et al., Organic Chemistry, 2nd Ed. New York: Worth, 1975.

Streitwieser, A. and C. Heathcock. Introduction to Organic Chemistry. New York: MacMillen, 1975.

Wingrove, A. and R. Caret. Organic Chemistry. New York: Harper and Row, 1981.

Hendrickson, J., et al. Organic Chemistry. 3rd Ed. New York: McGraw-Hill, 1970.

Kemp, D. and A. Vellaccio. Organic Chemistry. New York: Worth, 1980.

Gutsche, R. and A. Pasto. Fundamentals of Organic Chemistry. Englewood Cliffs: Prentice-Hall, 1975.

Roberts, J. and M. Caserio. Organic Chemistry. Menlo Park: Benjamin, 1971.

Landgrebe, L. Theory and Practice in the Organic Laboratory. 2nd Ed. Lexington: Heath, 1977.

McNair, H. and E. Bonelli. Basic Gas Chromatography. 5th Ed. Berkeley: Consolidated Printers, 1969.

Silverstein, R., et al., Spectrometric Identification of Organic Compounds. 3rd Ed. New York: Wiley, 1974.

REQUIRED WRITING:
LECTURE:
Answers to assigned questions involving definitions, concepts and theory. Answers to quizzes and exams in addition to calculations for problems. This usually entails 3 midterm exams and one final exam.

LABORATORY:
Laboratory notebook and/or short answers to questions in lab reports. Laboratory reports requiring extensive discussion and conclusions (summaries). Usually a total of 6 laboratory reports, consisting of a minimum of five pages per week, are required.

OUTSIDE ASSIGNMENTS:
Students are expected to spend a minimum of three hours per unit per week in class and on outside assignments, prorated for short-term classes.

LECTURE:
A student is expected to spend a minimum of two hours preparation outside of class for each hour of classroom time. Preparation may include such activities as literature search, review of lecture material, assigned problem sets, etc.

LABORATORY:
Lab work will normally include analysis of data, writing of lab reports and lab notebook maintenance. Notebooks may require somewhat extensive writing.

INSTRUCTIONAL METHODOLOGY:

Check all that apply:
_X_ lecture
_X_ laboratory
_____ lecture-laboratory combination
_____ directed study

DISTANCE LEARNING:

This course may be offered as a distance learning course and meets Title 5 regulations 55370, 55372, 55374, 55376, 55378, and 55380.
Yes ____ No_X_

If yes, check all that apply:

_____ Television Course (Video one-way, e.g. ITV, video cassette, etc.)
_____ Online Course (Text one-way, e.g. newspaper, correspondence, electronic file, etc.)
_____ Two-Way Video Conferencing (Two-way interactive video and audio)
_____ One-Way Video Conferencing (One-way interactive video and two-way interactive audio)
_____ Computer Assisted Instruction (A specialized form of mediated instruction relying primarily on student access to information and prepared lessons or teaching materials through a computer terminal, but not under immediate supervision of a qualified instructor.)

GRADING POLICY AND STANDARDS (include methods of determining whether the stated objectives have been met by students):

Finals comprise approximately 70%
Laboratory notebook approximately 30%

Total of points of combined lecture and laboratory are then subjected to standard curve.

A = 85-100% B = 71-84% C= 55-70% D = 45-55% F = 0-44%

IS COURSE REPEATABLE FOR REASON(S) OTHER THAN DEFICIENT GRADE?
Yes ____ No X Number of times course may be taken for credit: 1

If yes, identify specific provision of Title 5 Division 2 section(s), 55761-55763 and 58161 which qualifies course as repeatable:

CONTACT PERSON: David Boyajian

SIGNATURES ON FILE