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 220 - Organic Chemistry

UNIT VALUE: 5

MINIMUM NUMBER OF SEMESTER HOURS: 114

BASIC SKILLS REQUIREMENTS: Appropriate language and computational skills.

ENTRANCE REQUIREMENTS

PREREQUISITE: A minimum grade of "C" in CHEM 110 and CHEM 110L

COREQUISITE: None

RECOMMENDED PREPARATION: CHEM 115 and CHEM 115L

SCOPE OF COURSE:
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 syntheses 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 be able to:
1. To experimentally and/or theoretically investigate the properties, specific points of reaction and stability of a particular organic system.
2. To plan and conduct general laboratory research skills and to draw conclusions from the data obtained.

CONTENT IN TERMS OF SPECIFIC BODY OF KNOWLEDGE:
I. Carbon compounds and chemical bonds
   A. Review of covalent bonding, including orbital hybridization and quantum mechanical concepts
II. Representative carbon compounds
   A. Introduction to special structural features and functional group concepts
III. Alkanes and cycloalkanes
   A. Conformational analysis
   B. Introduction to nomenclature of hydrocarbons, alkyl halides and alcohols
   C. Chemical reactions of alkanes including substitution reactions with halogens
   D. Synthesis reactions of halogens

IV. Stereochemistry
- A. Chiral molecules.
- B. Enantiomers and chiral molecules
- C. Nomenclature of enantiomers
- D. Optical activity
- E. Stereoisomerism of cyclic compounds

V. Ionic reactions-nucleophilic substitution and elimination reactions of alkyl halides
- A. Thorough examination of all aspects mechanisms of Sn1, Sn2, E1, and E2 reactions using alkyl halides as reactant

VI. Alkenes and alkynes
- A. Properties and synthesis
- B. Nomenclature of alkenes, cycloalkenes and alkynes
- C. Alkene stability - Zaitsev's rule
- D. Synthesis of alkenes by elimination reactions
- E. Carbonation stability and molecular rearrangements
- F. Terminal alkyne chemistry

VII. Addition reactions of the carbon-carbon double bond synthesis of alcohols and alkyl halides
- A. Addition of hydrogen halides to alkenes
- B. Markovnikov's rule - regioselective reactions
- C. Halogen and hydrogen halide addition reactions/anti-Markovnikov addition of hydrogen bromide
- D. Addition reactions of alkynes involving halogens, hydrogen halides and water
- E. Planning organic syntheses

VIII. Alcohols and ethers
- A. Structure, nomenclaure review, properties and important alcohols and ethers
- B. Synthesis of alcohols via addition, oxymercuration-demercurations and dehydrobromination-oxidation
- C. Reactions of alcohols via O-H bond C-O bond cleavage, reactions of alcohols with hydrogen halides, PBr_3 and $SOCL_2$
- D. Polyhydroxy alcohols
- E. Synthesis and reactions of ethers

IX. Free radical reactions
- A. Free radical halogenation of alkanes
  1. Stereochemistry
  2. Polymerization

X. Conjugated unsaturated systems
- A. Assessment of the stability of the carbon radical using resonance
- B. Assessment of the stability of the allyl cation using resonance
- C. Allylic substitution
- D. Assessment of the stability of conjugated and nonconjugated alkadienes
- E. The Diels-Alder reaction

XI. Aromatic Compounds
- A. Reactions of benzene
- B. Theories of the structure of the benzene molecule
  1. Huckel rule
  2. Consideration of other aromatic compounds
- C. Nomenclature of benzene derivatives
- D. Heterocyclic aromatic compounds
  1. Biochemical compounds

XII. Aromatic compounds and electrophilic aromatic substitution
- A. Mechanism for electrophilic aromatic substitution
- B. Consideration of mechanisms for halogenation, nitration sulfonation and Friedel-Crafts alkylation and acylation
- C. Theory of electrophilic aromatic substitution
  - 1. Assessment of effect of substituents on reactivity and orientation
- D. Aromatic side chain reactions
- E. Synthetic applications

CHEM 220 LABORATORY EXPERIMENTS:

1. Safety
2. Calibration of thermometer: Determination of melting point
3. Simple & fractional distillation/gas chromatography
4. Discussion of chemical instrumentation
5. Recrystallization of an impure solid
6. Extraction
7. Thin-layer chromatography
8. Extraction & purification of crude caffeine
9. Relative ease of substitution of hydrogen in different environments
10. Preparation of 3 bromocyclohexene
11. Preparation of 2-chloro-2-methylpropane
12. Synthesis of n-propyl-p-xylene
13. Geometric isomerization of dimethyl maleate
14. Synthesis of dicyclopentadiene (Diels-Adler)
15. Preparation of sulfanilamide from acetanilide

REQUIRED READING:

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

Boyajian, David. Experimental Organic Chemistry. San Marcos: Palomar College Graphics, 1999.

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

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 definition, 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 10 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:
Preparation may include such activities as literature search, review of lecture material, assigned problem sets, etc. Students should study and prepare for exams.

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):
Based upon lecture exams and laboratory notebooks.
Lecture exams and finals comprise approximately 70% of grade.
Laboratory notebook approximately 30%.
Total points of the combined lecture and laboratory are then subjected to standard curve.

A = 85-100% B = 71-84% C = 55-70% D = 45-54% 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