SYLLABUS

CHE*K210 Introduction to Organic Chemistry
Three Rivers Community College
Norwich, Connecticut 06360

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Office Hours: MTW 2:30-3:30

**********Special Notice**********

If you have a visible or hidden disability which may require classroom, lab, and/or test-taking modifications, please see me as soon as possible. If you have not registered with Chris Scarborough, learning specialist at (860) 823-2985 or a counselor in the Student Services Development Center, you must do so early in the semester.

Course: Introduction to Organic Chemistry / CHE 210

Credits: 4 credit hours (3 hours of lectures and 3 hours of lab each week)

Text: Essential Organic Chemistry, Bruice, 2nd ed., Prentice Hall.
Other Required Materials: chemical safe goggles, calculator, nitrile gloves (available in bookstore).

Prerequisites: MAT*K137 or higher and CHE*K111 or CHE*K121 and CHE*K122, all courses passed with a "C" grade or better.

Description of the Course:

A) Catalogue Description: A one semester introductory organic chemistry course designed for students that need a general knowledge of organic compounds in science and technology related fields. Both theoretical and practical applicactions of carbon compounds will be studied. Topics include: nomenclature, the major groups of hydrocarbons and their derivatives, functional groups, reaction mechanisms, carbohydrates, lipids, proteins and nucleic acids. Modern laboratory techniques involving separations and analysis (infrared and nuclear magnetic resonance spectroscopy) will also be introduced. (This course is not recommended for science and technology programs requiring two semesters of organic chemistry).

B) General Course Objectives:

1) To aid the student in developing an understanding of the basic principles of organic chemistry.

2) To aid the student in developing critical thinking skills.

3) To aid the student in understanding the interrelationship between organic chemistry and other branches of chemistry and other areas of science.

Class Attendance Policy:

Attendance of all class activities in lecture and laboratory is required. Absences are counted from the first meeting of class. More than four consecutive or more than six accumulative absences could result in a student receiving a "F" grade in this course. An explanation of the cause of all absences should be given to your instructor.

Academic and Classroom Misconduct:

The instructor has primary responsibility for control over classroom and/or laboratory behavior and maintenance of academic integrity, and can request the temporary removal or exclusion from the classroom or laboratory of any student engaged in conduct that violates the general rules and regulations of the institution. Or any student engaged in conduct deemed hazardous in the laboratory. Extended or permanent exclusion from lecture or laboratory activities or further

disciplinary action can only be effected through appropriate procedures of the institution. Plagiarism, cheating on quizzes or tests, or any form of academic dishonesty is strictly prohibited. Students guilty of academic dishonesty directly or indirectly will receive a zero for the exercise or quiz or test and may receive a "F" grade for the course in addition to other possible disciplinary sanctions which maybe imposed through the regular institutional procedures. Any student that believes that he or she has been erroneously accused may appeal the case through the appropriate institutional procedures if their grade was affected.

Procedure for Dropping the Course:

College's Withdrawal Policy

Any student who finds it necessary to discontinue this course MUST complete a withdrawal form in the Registrar's Office at the time of the withdrawal. Students may withdraw from the course any time during the 14 weeks of class to receive a "W" grade for the course (Deadline will be announced). Students who do not withdraw, but stop attending will be assigned an "F" grade in in this course. Verbal withdrawals CANNOT be accepted. If you are unable to withdraw in person, you may call the Registrar's Office and provide them with the appropriate information. **Once you withdraw from the course you are no longer eligible to attend class or take any remaining quizzes or tests.**

Grade Determination

3 Tests…….50% of grade
Final Exam (cumulative)…….25% of grade
Lab*……..……..25% of grade

*The lab grade will be based on two lab practicals (tests) and lab reports.

Example:

Test avg:	90	@50% = 45
Lab avg (reports/practicals):	92	@25% = 23
Final Exam:	96	@25% = 24
		92 = course grade

Grade Scale: There will be NO grading on the normal distribution curve.

100.00 - 93.50 = A	79.49 - 77.50 = C+
93.49 - 90.00 = A-	77.49 - 73.50 = C
89.99 - 87.50 = B+	73.49 - 69.50 = C-
87.49 - 84.50 = B	69.49 - 63.50 = D+
84.49 - 79.50 = B-	63.49 - 59.50 = D
	59.49 - 00.00 = F

Make-ups:

Any assignment missed can be obtained from the instructor. Lab work cannot be made up. Unit tests can only be made up by special arrangement with the instructor. Makeup tests will be granted on an individual basis only following a conference with the instructor; where the reason(s) for missing the test must be determined mitigating circumstances beyond the control of the student such as, illness, death in the family, or change in condition of employment. If two unit tests are missed during the semester and/or if the final exam is missed the student will receive a "F" grade if he or she is failing other parts of the course or an "I" if the student is passing all other parts of the course.

Revisions to the Syllabus:

Students are responsible for learning all of the objectives and all of the items in the course outline whether they are discussed in lecture and/or laboratory or not. The instructor reserves the right to revise the objectives, topical outline, or academic schedule contained in this syllabus without notice. However, if the revisions affect scheduled unit tests a 48-hour notice will be given for the new test date.

Cellular Phones and/or Beepers:

Cellular phones and beepers are only allowed in class or lab if they are turned off or in silent mode. Under no circumstances are phones to be answered in class. When there are extenuating circumstances that require that a student be available by phone or beeper, that student must speak to the instructor prior to class, so that together they can arrive at an agreement.

Course Outcomes: CHE K210 Introduction to Organic Chemistry

Outcomes 1-8 learned from prerequisite courses

1. The student will be able to describe the scientific method through examples and distinguish among the terms hypothesis, theory and scientific law.

2. The student will learn both the differences and relationships between science and technology.

3. The student will be able to distinguish between data and results.

4. The student will be able to define chemistry, and know its major subfields.

5. The student will recognize the interrelationships of the structure of matter and its physical and chemical properties.

6. The student will be able to understand the current model of modern atomic structure including the major particles that comprise the atom: protons, neutrons and electrons.

7. The student will be able to distinguish between atoms, ions, and isotopes.

8. The student will be able to explain the differences between ionic and covalent bonding, as well as, the differences between polar and non-polar covalent bonding.

9. The student will be able to list the major classes of organic compounds.

10. The student will learn to write condensed and structural formulas for saturated and unsaturated hydrocarbons.

11. The student will learn the rules of the I. U. P. A. C. nomenclature system.

12. The student will be able to draw structural isomers of simple organic compounds.

13. The student will write equations for combustion and halogenation reactions of hydrocarbons.

14. The student will write equations for addition reactions of alkenes, and apply Markovnikov's rule.

15. The student will learn the more common functional groups.

16. The student will learn the name and structure of the various hydrocarbon derivatives.

17. The student will learn the basic structural differences between aliphatic and aromatic compounds.

18. The student will be able to write the general structures for alcohols, phenols, ethers, thiols, aldehydes, and ketones.

19. The student will learn to classify alcohols as primary, secondary, or tertiary.

20. The student will write equations for dehydration and oxidation of alcohols.

21. The student will write equations for the oxidation and reduction of carbonyl compounds.

22. The student will write equations for the preparation of hemiacetals, hemiketals, acetals, and ketals.

23. The student will learn about carboxylic acids and esters that are of biomedical or environmental importance.

24. The student will draw and name the more common carboxylic acids and esters.

25. The student will learn the biological significance of thioesters and phosphoesters.

26. The student will write equations for the hydrolysis of esters.

27. The student will write equations for the synthesis of a carboxylic acid by the oxidation of primary alcohols or aldehydes.

28. The student will write equations for the synthesis of esters from carboxylic acids and alcohols.

29. The student will be able to define the term saponification and know how a soap works in the emulsification of grease and oils.

30. The student will be able to draw and name simple amines and amides.

31. The student will be able to list amines and amides of biomedical and environmental importance.

32. The student will be able to classify amines as primary, secondary, or tertiary.

33. The student will be able to draw and discuss the structure of the amide bond.

34. The student will write equations showing the basicity and neutralization of amines.

35. The student will write equations for the preparation and hydrolysis of amides.

36. The student will learn the differences between simple and complex carbohydrates.

37. The student will draw and name the common, simple carbohydrates using structural formulas and Fischer projection formulas.

38. The student will be able to recognize whether a sugar is reducing or nonreducing.

39. The student will be able to discuss the structural, chemical, and biochemical properties of the monosaccharides, oligosaccharides, and polysaccharides.

40. The student will become familiar with the physical and chemical properties and the biochemical functions of each of the families of lipids.

41. The student will learn the name of the more common lipids.

42. The student will learn the method of synthesizing glycerides and the reaction of glycerides, esterification, hydrolysis, saponification, and dehydrogenation.

43. The student will be able to write the general structure of an amino acid.

44. The student will learn the classification of R groups of the amino acids.

45. The student will be able to describe the four levels of protein structure.

46. The student will learn the name and and functions of the more common proteins of biological importance.

47. The student will be able to give biochemical properties of enzymes and explain enzymatic activity, as well as, the role of coenzymes and cofactors.

48. The student will name the six classes of enzymes based on the reactions they catalyze and the four types of enzyme specificity.

49. The student will describe the biochemical composition of the nucleic acids.

50. The student will describe the structure of both DNA and RNA.

51. The student will be able to list the three classes of RNA.

52. The student will be able to describe the biochemical mechanism of DNA replication.

53. The student will be able to explain the role of DNA and RNA in protein synthesis. (Transcription and Translation).

54. The student will be able to explain the role of spectroscopy in organic chemistry.

COURSE OUTLINE: INTRODUCTION TO ORGANIC CHEMISTRY
PART I: REVIEW

I. Science
A. What is Science?
1) The Scientific Method
B. Data, Results, and Units
C. Science and Technology
D. What is Chemistry?
1) Inorganic chemistry
2) Organic chemistry
3) Analytical chemistry
4) Physical chemistry
5) Biochemistry

II. Matter and Properties
A. Physical properties of matter
B. Chemical properties of matter
C. Development of the atomic theory
D. Modern atomic theory
E. Atomic structure
1) Protons
2) Neutrons
3) Electrons
a) valence electrons
b) ion formation and the octet rule
4) Isotopes
F. Ions and ionic bonding
G. Covalent bonding
1) Non-polar
2) Polar
H. Acids and Bases

PART II: ORGANIC CHEMISTRY

I. Introduction
A. The carbon atom
B. Covalent bonding in organic compounds

II. Organic Molecules
A. Molecular formulas and types of structural formulas
B. Resonance
C. Structural isomers

III. The Hydrocarbons
A. Alkanes and cycloalkanes
1) Structure of alkanes

2) Isomerism in alkanes
3) The IUPAC system of nomenclature
4) Naming alkanes
5) Cycloalkanes
6) Cis/trans isomerism in cycloalkanes
7) Physical properties of alkanes and cycloalkanes
8) Reactions of alkanes
B. Alkenes and Alkynes
1) Structure of alkenes
2) Naming alkenes
3) Physical properties of alkenes
4) Naturally occurring alkenes
5) Structure of alkynes
6) Naming alkynes
7) Physical properties of alkynes
C. Reactions of Alkenes
1) Reaction mechanisms
2) Addition reactions
3) Electrophilic addition reactions
4) Oxidation reactions
5) Reduction reactions
6) Polymerization
D. Aromatic Compounds
1) Substituted benzene compounds/aromaticity
2) Polycyclic and heterocyclic aromatic compounds
3) Nomenclature of benzene compounds
4) Electrophilic aromatic substitution
a) Structural effects
b) Interpretation of rate effects
c) Interpretation of directing effects
5) Reactions of side chains
6) Functional group modification
7) Synthesis of substituted aromatic compounds
E. Stereochemistry
1) Isomerism
2) Chirality
3) Naming enantiomers
4) Fischer projection formulas
5) Cyclic molecules with two or more stereocenters
6) Noncyclic molecules with two or more stereocenters
7) Properties of stereoisomers
8) Separation of enantiomers
9) How chirality is detected in the laboratory
10) Reactions that produce stereocentered molecules
F. Functional Groups
1) Names

2) Structural formulas
G. Alkyl Halides
1) Naming alkyl halides
2) Preparation of alkyl halides
- radical chlorination of alkanes
3) Alkyl halides from alcohols
4) Reactions of alkyl halides
- Grignard reagents
H. Nucleophilic Substitution and Elimination Reactions
IV. Hydrocarbon derivatives
A. Alcohols and Phenols
1) The hydroxyl group
2) Classification and nomenclature of alcohols
3) Physical properties of alcohols
4) Reactions of alcohols
a) Acid-Base
b) Substitution
c) Dehydration
d) Oxidation
e) Synthesis
5) Phenols
6) Synthesis and reactions of phenols
7) Thiols and sulfides
B. Ethers and Epoxides
1) Ethers
a) Nomenclature
b) Physical properties
c) The Grignard reagent and ethers
d) Synthesis of ethers
e) Reactions of ethers
2) Epoxides
a) Synthesis of epoxides
b) Reactions of epoxides
C. Aldehydes and Ketones
1) The carbonyl group
2) Nomenclature of aldehydes and ketones
3) Physical properties of aldehydes and ketones
4) Redox reactions of carbonyl compounds
5) Addition reactions of carbonyl compounds
6) Synthesis of alcohols from carbonyl compounds
7) Addition of oxygen compounds
8) Formation of acetals and ketals
9) Addition of nitrogen compounds
10) Reactivity of the alpha carbon atom
11) The aldol condensation

D. Carboxylic Acids and Esters
1) The carboxyl and acyl groups
2) Nomenclature of carboxylic acid derivatives
3) Physical properties of carboxylic acids and esters
4) Acidity of carboxylic acids
5) Synthesis of carboxylic acids
6) Nucleophilic acyl substitution
7) Reduction of acyl derivatives
8) Synthesis of esters
9) Hydrolysis of esters
10) The claisen condensation
11) Thioesters
E. Amines and Amides
1) Organic nitrogen compounds
2) Structure and classification of amines and amides
3) Nomenclature of amines and amides
4) Physical properties of amines and amides
5) Basicity of nitrogen compounds
6) Solubility of ammonium salts
7) Nucleophilic reactions of amines
8) Synthesis of amines
9) Hydrolysis of amides
10) Synthesis of amides
11) Amides molecular models
12) Amphetamines and polyamides
F. Synthetic Polymers
V. The Organic Chemistry of Biomolecules
A. Carbohydrates
1) Classification of carbohydrates
2) Chirality of monosaccharides
3) Hemiacetals and hemiketals
4) Conformation of monosaccharides
5) Reduction of monosaccharides
6) Oxidation of carbohydrates
7) Glycosides
8) Disaccharides/Oligosaccharides/Trisaccharides
9) Polysaccharides
10) The biological function of carbohydrates
B. Lipids
1) Classification of lipids
2) Fatty acids
a) Structure and properties
b) Chemical reactions of fatty acids
c) Prostaglandins

3) Glycerides
a) Neutral glycerides
b) Phosphoglycerides
4) Nonglyceride lipids
a) Sphingolipids
b) Steroids
5) Cholesterol
6) Waxes
7) Saponification of triacylglerides
8) The biological functions of lipids
C. Amino acids, Peptides, and Proteins
1) The basic structure and naming of amino acids
2) Acid-base properties of amino acids
3) Essential amino acids
4) Peptides
5) Synthesis of peptides
6) Polypeptides and protein
7) Structure determination of proteins
8) Structure of proteins
9) Enzymes
a) structural composition (coenzymes and cofactors)
b) classification and function
10) Lipoproteins
11) The biological functions of proteins
D. Nucleosides, Nucleotides, and Nucleic Acids
1) The composition of nucleosides
2) Naming nucleosides
3) Nucleotides
a) Composition
b) Classification
4) Nucleic acids and nucleotides
5) The structure of DNA: Watson and Crick Model
6) DNA replication
7) Structure and synthesis of RNA/classification of RNA
8) The genetic code
9) Protein synthesis: Transcription and Translation
10) DNA sequencing and polymerase chain reaction
VI. Spectroscopy and Organic Chemistry
A. Optical isomerization
B. Infrared (IR) spectroscopy
C. Nuclear magnetic resonance (NMR) spectroscopy

Tentative Academic Schedule: CHE*K210 Introduction to Organic Chemistry

Lecture (12374): MW 5:00-6:25 p.m. D230
Lab (12375): T 5:00-8:00 p.m. B222

week 1
Class does not meet

week 2
M 1/23 Electronic Structure and Covalent Bonding Ch 1.
T 1/24 *Lab- Orientation, Safety.*
W 1/25 Electronic Structure and Covalent Bonding Ch 1 cont'd.

week 3
M 1/30 Acids and Bases Ch 2/Review of Oxidation-Reduction.
T 1/31 *Lab- Purification Techniques: Extraction.*
W 2/01 Introduction to Organic Compounds Ch 3.

week 4
M 2/06 Introduction to Organic Compounds Ch 3 cont'd.
T 2/07 *Lab- Purification Techniques: Recrystallization.*
W 2/08 Alkenes Ch 4.

week 5
M 2/13 Alkenes Ch 4 cont'd/Reactions of Alkenes and Alkynes Ch 5.
T 2/14 *Lab- Purification Techniques: Distillation..*
W 2/15 Rxns of Alkenes and Alkynes Ch 5 cont'd.

week 6
M 2/20 PRESIDENTS' DAY- Class does not meet.
T 2/21 *Lab- Analytical Technique: Thin-Layer Chromatography.*
W 2/22 **UNIT TEST 1 (Ch1-5)**

week 7
M 2/27 Substitution and Elimination Reactions of Alkyl Halides Ch 9.
T 2/28 *Lab- Organic Reactions: Nucleophilic Substitution.*
W 2/29 Substitution and Elimination Reactions of Alkyl Halides Ch 9 cont'd/Isomers and Stereochemistry Ch 6.

week 8
M 3/05 Isomers and Stereochemistry Ch 6 cont'd.
T 3/06 ***LAB PRACTICAL I***
W 3/07 Delocalized Electrons, Effect on Stability, Reactivity and pKa; UV/Vis Spectroscopy Ch 7.

week 9
M 3/12 Determining the Structures of Organic Compounds Ch 14.
T 3/13 *Lab- Data Interpretation I: ^{1}H NMR/IR Spectroscopy.*
W 3/14 Determining the Structures of Organic Compounds Ch 14 cont'd.

week 10
M 3/19 SPRING BREAK
T 3/20 SPRING BREAK
W 3/21 SPRING BREAK

week 11
M 3/26 Aromaticity Ch 8.
T 3/27 *Lab- Data Interpretation II: ^{1}H NMR/IR Spectroscopy.*
W 3/28 Aromaticity Ch 8 cont'd.

week 12
M 4/02 **UNIT TEST 2 (Ch 6-9; 14)**
T 4/03 *Lab- Organic Reactions: Elimination.*
W 4/04 Reactions of alcohols, Amines, Ethers, and Epoxides Ch 10.

week 13
M 4/09 Reactions of alcohols, Amines, Ethers, and Epoxides Ch 10 cont'd.
T 4/10 *Lab- Organic Reactions: Reduction.*
W 4/11 Carbonyl Compounds I: Carboxylic Acids and Their Derivatives Ch 11.

week 14
M 4/16 Carbonyl Compounds II: Aldehydes and Ketones Ch 12.
T 4/17 *Lab- Organic Reactions: Esterification.*
W 4/18 Carbonyl Compounds III: Reactions at the Alpha-Carbon Ch 13.

week 15
M 4/23 Carbohydrates Ch 15.
T 4/24 *Lab- Organic Reactions: Aldol Condensation.*
W 4/25 Carbohydrates Ch 15 cont'd/

week 16
M 4/30 Lipids Ch 19
T 5/01 *Lab- Applications of Organic Reactions: Soap and Biodiesel (Saponification and Transesterification).*
W 5/02 **UNIT TEST 3 (Ch 10-13; 15, 19)**

week 17
M 5/07 Amino Acids, Peptides, and Proteins Ch 16
T 5/08 ***LAB PRACTICAL II***
W 5/09 Enzymes and Nucleic Acids Ch 17, 20.

week 18
M 5/14 Review for Final Exam
T 5/15
W 5/16 **FINAL EXAM (cumulative)**