CHEM-3760 ORGANIC CHEMISTRY III

WINTER SEMESTER 2016

Information Sheet and Course Outline

An in-depth treatment of various aspects of organic chemistry. This will include such topics as chemistry of heterocycles, synthetic strategies, polar rearrangements and a detailed discussion of organic spectroscopy. **Prerequisite: CHEM*3750 (CHEM*2070)**

- **Instructor**: Professor Richard A. Manderville

  Office: SC 3243, Phone: 824-4120 (Ext. 53963)

  e-mail: rmanderv@uoguelph.ca

  Office hours: tba

- **Textbooks**:

  (a) "Introduction to Spectroscopy", 3rd Ed., by Pavia, Lampman and Kriz, Saunders College Publishing, 2001. (**PLK3**) OR "Introduction to Spectroscopy", 4th Ed., by Pavia, Lampman, Kriz and Vyvyan, Brooks/Cole, 2009. (**PLKV**)

  (b) "Organic Chemistry" and "Study Guide and Solutions Manual to Organic Chemistry", 10th Ed., by Solomons and Fryhle, John Wiley & Sons, Inc., 2011. (**SF**)

  Also Available:

  (c) "Advanced Organic Chemistry: Reactions and Mechanisms", 2nd Ed. by B. Miller, Prentice-Hall, Inc., 2004.

- **Lectures**: There will be three lectures each week: M, W, F 1:30-2:20 pm in **GRHM 2310.** The lectures notes for Organic Chemistry III, CHEM*3760, will be available as pdf files on CourseLink. The lab manual can be purchased in SCIE 2101 (cash only). It is assumed that you are familiar with the material covered in CHEM*2700 and CHEM*3750 and you may wish to have your notes for those courses available to review topics as needed.

- **Laboratory**: The lab manual "Organic Chemistry III, CHEM*376, Laboratory Outline", revised Winter 2015, will be available for sale by the Department as indicated. Students must provide their own safety goggles. A student without eye protection will not be permitted to work in the laboratory. Contact lenses are extremely hazardous in a laboratory environment and they

are not recommended in the lab. SAFETY GOGGLES MUST BE WORN AT ALL TIMES IN THE CHEM*3760 LABORATORY.

Students must complete at least 60% of the laboratory work to receive a passing grade for the course.

- **Grading**: The final grade will be obtained as follows:

Term Test 1	20%	(In class, Wed Feb. 24th, take-home due Fri Feb. 26th, Spectroscopy)
Term Test 2	10%	(In class, Wed Mar. 23, Chapters 2-3)
Laboratory	30%	Expectations and deadlines will be defined in the lab.
Final Exam	40%	2:30PM - 4:30 PM, Apr. 22/2016

**** If you miss the final exam or a major mid-term for medical or compassionate reasons, you are expected to provide verification of those reasons before you receive a passing grade, credit standing or a deferred privilege.**

**** As part of the faculty evaluation process in the Department of Chemistry, students are reminded that written comments on the teaching performance of the lecturer may be sent to the Chair, Department of Chemistry, at any time. Such letters must be signed; a copy, will be made available to the instructor after submission of final grades.**

CHEM*3760 ORGANIC CHEMISTRY III

Course Outline

1. Chapter 1: **Organic Spectroscopy**

(a) Mass Spectrometry
(b) Infrared Spectroscopy
(c) Ultraviolet Spectroscopy
(d) ^{1}H NMR Spectroscopy
(e) ^{13}C NMR Spectroscopy
(f) 2D NMR Experiments

2 Chapter 2 **Heterocyclic Chemistry**

(a) Nomenclature of Heterocyclic Compounds
(b) Properties: Aromaticity, Dipole Moment, Basicity
(c) Synthesis of Non-Aromatic Heterocycles: Intramolecular Cyclization; Cycloaddition (Epoxidation, Paterno-Buchi Reaction, Aziridination); Hydrogenation
(d) Reaction of Non-Aromatic Heterocycles: Ring-opening Reactions of 3-membered Ring Heterocycles; Nucleophilic addition of Aziridines; Rearrangement of Aziridines; Ring-opening of Higher-member Heterocycles
(e) Synthesis and Reactions of Indoles: Fischer Indole Synthesis, Bischler Indole Synthesis; Aromatic Electrophilic Substitution Reactions of Indoles
(f) Synthesis and Reactions of Quinoline: Electrophilic Aromatic Substitution;
(g) Other Important Heterocycles: Crown Ethers, Dihydropyran & Tetrahydropyran, Dioxanes, 1,3-Dithiane; Thiirane, DNA/RNA Bases.

3 Chapter 3: Pol**ar Rearrangements**

(a) Rearrangements of Carbocations: Wagner-Meerwein Shifts, Pinacol Rearrangement, Dienone-Phenol Rearrangement, Fries Rearrangement

(b) Rearrangement of Carbanions & Carbenoids: Favorskii Rearrangement, Semibenzillic Rearrangement, Benzillic Rearrangement, Ramberg-Backlund Rearrangement, Wolff Rearrangement

(c) 1,2-Nucleophilic Rearrangement to Electron Deficient Nitrogen & Oxygen: Beckmann Rearrangement, Hofmann Rearrangement, Curtius Rearrangement, Schmidt Rearrangement, Baeyer-Villiger Rearrangement, Hydroperoxide Rearrangement

4. Chapter 4 **Designing Organic Syntheses**

(a) One, two and illogical disconnections.

(b) Synthesis of Heteroatoms and heterocyclic compounds.

(c) General Synthetic problems.

Course Objectives

Chapter 1: To be able to:
-elucidate organic structures based on available characterization data
-draw conclusions about structural features based on characterization data
-predict spectral data of structures based on available data and analogies

Chapter 2: To be able to:
- understand the importance of and draw selected heterocyclic compounds
-recognize important heterocyclic structures and draw their mechanism of formation, based on starting material structures
-identify and draw starting materials based for selected heterocyclic compounds
-recognize the role of selected regents in the formation of specific heterocyclic compounds

Chapter 3: To be able to:
--to predict and draw the structures of rearranged compounds when provided with starting materials and reagents
-draw the mechanisms using curly arrows for rearrangement reactions
-recognize and distinguish between similar rearrangement reactions

Chapter 4: To be able to:
-analyze simple reaction sequences in a retrosynthetic manner: propose logical starting organic compounds when presented with larger substrates

Academic misconduct

Students in CHEM*3760 are expected to be familiar with University of Guelph Academic Misconduct expectations and regulations found at:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

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Types of offenses are described at:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconductoffen.shtml

Books on reserve

For lectures

Introduction to Spectroscopy, D.L. Pavia, G.M. Lampman, G.S. Kriz QD272.S6 P38 2001 3rd Ed.

Organic spectroscopy 3rd ed. W. Kemp QD 272.S6 K45 1991

Spectrometric identification of organic compounds 5th ed. R. M. Silverstein, G.C. Bassler, T.C. Morrill QD272.S6S55 1991

Aromatic Heterocyclic Chemistry, D.T. Davies, QD400 .D38 1993

Advanced Organic Chemistry Reactions and Mechanisms by B. Miller, QD251.2 .M534 2004 *2nd Ed.*

Polar Rearrangements, L.M. Harwood, QD 281.R35 H37 1995.

Intermediate Organic Chemistry, 2nd. Ed., J.C. Stowell, QD251.2.S75

Synthesis of Fused Heterocycles, G.P. Ellis, QD 400.E45

Principals of Organic Synthesis, R.O.C. Norman and J.M. Coxon, QD 262.N6 1993

Handbook of Heterocyclic Chemistry, A.R. Katritzky, QD 400.K29 2000

Essentials of organic chemistry: for students of pharmacy, medicinal chemistry and biological chemistry P.M. Dewick. QD251.3.D49 2006 Chapter 11 is a good heterocyclic chapter

Organic synthesis : the disconnection approach 2nd ed. S.G. Warren, P. Wyatt. QD262 .W284 2008

March's advanced organic chemistry : reactions, mechanisms, and structure.
6th ed. M. B. Smith, J. March QD251.2 .M37 2007

For laboratory

Introduction to Organic Laboratory Techniques : a Contemporary Approach. D. L. Pavia, G.M. Lampman, G.S. Kriz. QD 261.P38 1988

Microscale Organic Laboratory : with Multistep and Multiscale Syntheses, D.W. Mayo, R.M. Pike, P. K. Trumper, QD 261.M38 1994

Operational Organic Chemistry : a Laboratory Course, J. W. Lehman, QD 261.L39

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