SYLLABUS
CHEM 224 – ACCELERATED - Organic Chemistry B – 2nd semester
Summer 2012 - LOYOLA UNIVERSITY CHICAGO

Lecture/Discussion: #1416 / 1417  Sections: 003 / 004  M+W+F:  8:30 a.m. – 11:20 a.m.  Dumbach Hall 117

Dr. C. Szpunar
Office: Flanner Hall 200B  Contact: in person (preferred), by email: csszpunar@luc.edu, 773-508-3128
Student Office Hours (no appt needed): M and W: after class, 11:45 – 1:15, and *** by prior appt ***

Required:

Suggested / Recommended Materials:
1. Molecular modeling kit, Darling, Prentice-Hall, Freeman (Maruzen), Proteus, or equivalent
2. Spiral or bound notebook for homework problems

Optional Materials (found helpful by some students):

Grading (approx weight below) with grade guidelines: > 90%, A; 75-90%, B; 55-75%, C;  grading may be curved

MID-TERM EXAM – 1 – date scheduled and announced (subject to change, although unlikely)

!!! NO MAKE UPS !!! NO EARLY EXAMS !!!

25%

- UNEXCUSED ABSENCES merit a zero score.
- EXCUSED ABSENCES are handled on a case-by-case basis; grade weighting may be adjusted, depending on the circumstance(s); however, an excused absence MUST BE CORROBORATED and DOCUMENTED, e.g., accompanied by a note from the doctor, dentist, hospital rep, or funeral director; by a court summons, plane ticket stub, hospital release form, obit, or other, as appropriate. With proper documentation, religious observance, official representation of the university, or personal emergency may constitute an Excused Absence.

QUIZZES – 4 – dates announced (subject to change, although unlikely)  !!! NO MAKE UPS !!!

30%

FINAL EXAM

45%

Course Objective: To guide, encourage, and foster the learning and understanding of Organic Chemistry – nomenclature, structures, properties, reactions, mechanisms, and syntheses – by the individual student, helping him/her to connect, extrapolate, integrate, and apply the many different aspects learned.

Student Outcomes: If successful, the student will learn how to …

1. identify the various classes of organic compounds, their methods of preparation, and typical reactions.
2. name and draw specific organic compounds.
3. postulate a logical reaction mechanism for simple organic reactions.
4. discriminate amongst relative stabilities of reaction intermediates.
5. plan and write out multi-step syntheses using known functional group transformations.
6. prepare for basic purification/separation techniques of organic compounds required in the laboratory.
7. analyze and interpret data from various instruments used in separating and identifying organic compounds: IR, NMR, and UV-vis spectrophotometers and mass spectrograph.
Lecture and Discussion – Attendance and Attention: Important and required. Feel free to bring your books and modeling kit to class. Better yet, use them. Prepare for lecture by prior scanning of new material. Come prepared for discussion, ready to ask questions on assigned homework or yet unassimilated lecture material.

Phones and Pagers: Please be courteous and respectful of others. Silent mode during lecture and discussion. **Not allowed in sight or within hearing during exams, subject to confiscation.** NO phone conversations in lecture hall or in discussion class – before class, during class, after class – AT ANY TIME!

Academic Honesty: Essential, expected, and enforced. Dishonesty dictates consequences which may include: (1) notification of Chemistry Department Chair, student’s Department Chair, and CAS Dean, (2) documentation in the student’s official university record, and (3) dismissal from the university. Immediate consequences will include a **ZERO** on any item in question (quiz or exam). Please refer to the LUC Undergraduate Handbook on policies or the CAS website: [http://ww.luc.edu/cas/pdfs/CAS_Academic_Integrity_Statement_December_07.pdf](http://ww.luc.edu/cas/pdfs/CAS_Academic_Integrity_Statement_December_07.pdf).

Study Strategies and Suggestions: One may approach the study of Organic Chemistry in a manner similar to tackling a new foreign language. Its study will provide a basis to understanding future material – building constantly, incessantly, and relentlessly on the structural and mechanistic information presented previously. Over two semesters, the course will cover functional groups, aliphatic and aromatic compounds, bonding, nomenclature, stereochemistry, conformational analysis, reaction mechanisms, multi-step syntheses, and spectroscopy. Because the course is cumulative and builds heavily on prior material, the best plan is to study Organic Chemistry regularly, every day, similar to practicing the piano. Collaboration on homework problems is encouraged, especially in a timely fashion. Experience dictates that positive outcomes (for exam and course grades) are directly proportional to working and understanding the assigned problems on a regular basis, i.e., applying the concepts learned to non-generic compounds.

Typically, Organic Chemistry is not efficiently self-taught. **Overnight cramming will probably not produce success.** The student should quickly read the chapter/segment to be covered BEFORE lecture to improve lecture comprehension. After lecture, careful detailed re-reading of the chapter/segment and focused working of the assigned problems are appropriate, necessary, and expected. In addition to student’s participation in lecture, discussion, reading, and homework, joining and contributing to a study group is encouraged.

*If anticipating a passing grade of C, the minimal time per week in the summer devoted to Organic Chemistry is estimated at 9 hr for lecture/discussion, 6-12 hr for reading, and 6-12 hr for homework.*

**Suggested Homework Assignment** (Wade 7th edition):

- Chap 15: 1, 4-18, 22-27, 30
- Chap 16: 3-4, 7-8, 9 (a,b), 12-29, 32, 38-39, 45
- Chap 17: 1-2, 4-22, 24-27, 30-32, 38, 40-52
- Chap 18: 1-4, 6-12, 16-31, 34-40, 43-44, 47, 49, 51
- Chap 19: 1-21, 25-32, 34-42, 44, 47, 56, 58
- Chap 20: 1-33, 35-40, 45, 47, 50
- Chap 21: 1-39, 43-48, 50-54, 66
- Chap 23: 1-14, 16-17, 21-22, 24-26, 28-31, 32 (a), 33-36, 40, 41 (a,b), 52-55, 63
- Chap 24: 3-6, 20, 32, 33
- Chap 25: 1, 4, 8-9, 11-15, 32
- Chap 26: FYI, 21-29

**Wade 6th edition**

- Chap 15: 1, 4-18, 22-27, 30
- Chap 16: 3-4, 7-8, 9 (a,b), 12-29, 32, 38-39, 45
- Chap 17: 1-2, 4-22, 24-27, 30-32, 38, 40-52
- Chap 18: 1-4, 6-12, 16-31, 34-40, 43-44, 47, 49, 51
- Chap 19: 1-21, 25-32, 34-42, 44, 47, 56, 58
- Chap 20: 1-33, 35-40, 45, 47, 50
- Chap 21: 1-39, 43-48, 50-54, 66
- Chap 23: 1-14, 16-17, 21-22, 24-26, 28-31, 32 (a), 33-36, 40, 41 (a,b), 52-55, 63
- Chap 24: 3-6, 20, 32, 33
- Chap 25: 1, 4, 8-9, 11-15, 32
- Chap 26: 21-29
Topics: to be covered this semester:

12/13. Spectroscopy: Methods of Structure Determination (Review)
Electromagnetic spectrum, molecular vibrations, infrared spectroscopy, characteristic IR absorptions, IR spectra interpretation, mass spectrometry (MS), terminology associated with MS, nuclear spin, magnetic shielding, NMR spectrometer, chemical shift, chemical nonequivalence, peak integration, spin-spin splitting, time dependence, interpreting NMR spectra, combined spectroscopy problems.

15. Dienes, Conjugated Systems, UV Spectroscopy
Molecular orbital theory, 1,3-butadienes, electrophilic addition (1,2 and 1,4), NBS, Diels Alder rxn.

16/17. Aromatic Compounds
Benzene, Kekule structure, resonance, annulenes, MO theory, aromaticity, Huckel’s Rule, heterocyclic aromatics, electrophilic aromatic substitution, directing effects on electrophilic aromatic substitution, Friedel-Crafts alkylation and acylation, nucleophilic aromatic substitution, side-chain reactions of benzene derivatives, reactions of phenols.

18. Aldehydes and Ketones
Structure of the carbonyl group; nomenclature, physical properties, and spectroscopic properties of aldehydes and ketones; syntheses of aldehydes and ketones; addition reactions; Wittig reaction; condensation reactions; acetals; oxidation and reduction.

19. Amines
Nomenclature, structure, physical properties, basicity, salts of amines, phase transfer catalysis, spectroscopic properties, reactions of amines, sulfonamides, Hofmann elimination, Cope Elimination, arenediazonium salts, synthesis of amines.

20. Carboxylic Acids
Structure and nomenclature, physical properties, acidity, salts of carboxylic acids, spectroscopy, synthesis of carboxylic acids, nucleophilic acyl substitution, Fischer esterification, synthesis and use of acid chlorides, diazomethane, condensations of carboxylic acids, reduction, alkylation of carboxylic acids.

21. Carboxylic Acid Derivatives
Structure and nomenclature, physical properties, and spectroscopic properties of carboxylic acid derivatives, nucleophilic acyl substitution, hydrolysis of acid derivatives, reduction of acid derivatives, organometallic reactions, thioesters, carboxylic acid derivatives.

22. Enols and Enolates
Enols, enolates, alpha halogenation, alkylation of enolates, formation and alkylation enamines, aldol condensation, dehydration of aldol products, crossed aldol condensation, aldol cyclizations, Claisen condensation, Dieckmann condensation, crossed Claisen condensation, β-dicarbonyl compounds, Malonic ester synthesis, acetoacetic ester synthesis, conjugate addition, Michael reaction, Robinson annulation.

23. Carbohydrates
Classification of carbohydrates, monosaccharides, erthro and threo diastereromers, epimers, nomenclature, cyclic structures of monosaccharides, anomers, mutarotation, reactions of monosaccharides, oxidation and reduction of monosaccharides, non-reducing sugars, formation of glycoses, ether and ester formation, osazone formation, Ruff degradation, Kiliani-Fischer synthesis, Fischer’s proof of configuration, determination of ring size, periodic acid cleavage, disaccharides, polysaccharides.

Structure and stereochemistry of the α-amino acids, synthesis of amino acids, resolution, structure and nomenclature of peptides and proteins, peptide structure determination, peptide synthesis.

25. Lipids
Miscellaneous category, classification by solubility: waxes, triglycerides, soaps and detergents, phospholipids, steroids, prostaglandins, terpenes.
## Lecture Outline
(tentative, subject to change, but unlikely due to time constraints)

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Date</th>
<th>Chapters</th>
<th>Topic</th>
<th>*** EVENT ***</th>
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<tbody>
<tr>
<td>--</td>
<td>M-July 2</td>
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<td>Review – IR, MS, NMR</td>
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<tr>
<td>1</td>
<td>W-July 4</td>
<td>12/13</td>
<td>Independence Day Holiday – NO CLASS</td>
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<td>2</td>
<td>F-July 6</td>
<td>15</td>
<td>Conjugated Systems, UV Spectroscopy</td>
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<td>3</td>
<td>M-July 9</td>
<td>15/16</td>
<td>… / Aromatic Compounds</td>
<td>Quiz 1 (Chapters 12/13)</td>
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<td>W-July 11</td>
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<td>5</td>
<td>F-July 13</td>
<td>17</td>
<td>Aromatic Compounds - Reactions</td>
<td>Quiz 2 (Chapters 15-17)</td>
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<td>M-July 16</td>
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<td>W-July 18</td>
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<td>… / Aldehydes and Ketones</td>
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<td>F-July 20</td>
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<td>W-July 25</td>
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<td>F-July 27</td>
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<td>Quiz 3 (Chapters 18-19)</td>
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<td>12</td>
<td>M-July 30</td>
<td>19/20</td>
<td>… / Carboxylic Acids</td>
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<td>13</td>
<td>W-Aug 1</td>
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<td>14</td>
<td>F-Aug 3</td>
<td>20/21</td>
<td>… / Carboxylic Acid Derivatives</td>
<td>Quiz 4 (Chapters 20-21)</td>
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<td>*************************************** last day to withdraw with W, not WF</td>
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<td>15</td>
<td>M-Aug 6</td>
<td>21/22</td>
<td>… / Condensations, Alpha Substitutions, Enolates</td>
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<td>16</td>
<td>W-Aug 8</td>
<td>23/24</td>
<td>Carbohydrates / Amino Acids and Peptides</td>
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<td>17</td>
<td>F-Aug 10</td>
<td>25</td>
<td>Lipids / Q/A</td>
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<td>*************************************** Cumulative FINAL EXAM (focus: Chapters 18-23)</td>
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### Daily Schedule
(tentative, approximate, flexible, may adjust order):

<table>
<thead>
<tr>
<th>Regular Day</th>
<th>Quiz Day</th>
<th>Exam Day</th>
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<tbody>
<tr>
<td>08:30 – 09:00 am Q/A, admin</td>
<td>08:30 – 09:00 am Q/A</td>
<td>08:30 – 09:00 Q/A</td>
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<tr>
<td>09:00 – 10:00 <strong>lecture – 1</strong></td>
<td>09:00 – 10:00 <strong>lecture - 1</strong></td>
<td>09:00 – 10:20 <strong>lecture</strong></td>
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<tr>
<td>10:00 – 10:10 <em><strong>break</strong></em></td>
<td>10:00 – 10:10 <em><strong>break</strong></em></td>
<td>10:00 – 10:30 <em><strong>break</strong></em></td>
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<tr>
<td>10:10 – 10:30 discussion as time/topic permit</td>
<td>10:10 – 11:00 <strong>lecture – 2</strong></td>
<td>10:30 – 11:20 <strong>EXAM</strong></td>
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<tr>
<td>10:30 – 11:20 <strong>lecture - 2</strong></td>
<td>11:00 – 11:20 <strong>quiz</strong></td>
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| 08:30 – 09:10 Q/A | 09:10 – 09:20 ***break*** | 09:20 – 11:20 **FINAL** |