CHE 410: Spectroscopic Identification of Organic Compounds

Spring 2011

Instructor: Dr. Lili Ma
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Email: mal1@nku.edu

Prerequisite: A ‘C’ or better in CHE 310 is required to enter CHE 410.

Course Times: MW 9:00 ~ 9:50 AM, SC 402

Office Hours:
The formal office hours are Monday and Thursday 10:00 ~ 12:00 AM. I have an open door policy. You can also come by appointment. Please email me, call me, or just stop by.

Materials

Required
   This book is available in the library (QD272.S6 S55 2005).

Recommended

Course Description
Spectroscopic Identification of Organic Compounds CHE 410 is a one-semester, problem-based course. It aims to provide students proficiency in the use of spectrometric data to elucidate structural information of organic compounds or reactive intermediates. CHE 410 covers the four basic techniques frequently used in the structure interpretation of organic compounds: mass spectrometry (MS), infrared spectroscopy (IR), ultraviolet/visible spectroscopy (UV) and nuclear magnetic resonance (NMR). This course will start with developing the students’ ability to understand and verify spectra with known structures. Discussions on structure interpretation, reaction mechanism study and experimental design will then be gradually involved.

Learning Objectives
Upon the successful completion of the course, you should be able to:
• Comprehend the basic theory, instrumentation and features of MS, IR, UV and NMR
techniques.
- Understand the application, limitation and recent developments of these techniques.
- Develop an understanding of MS, IR, UV and NMR spectra. Identify the significant signals and explain its indication.
- Deduce structural information of organic compounds based on spectroscopic data.
- Understand how to use MS, IR, UV or NMR techniques to probe reaction mechanisms.
- Design experiments to follow reaction progress, or test hypothesized reactive intermediates.

### Course Outline

<table>
<thead>
<tr>
<th>Topic</th>
<th>Chapter</th>
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<tbody>
<tr>
<td>Introduction</td>
<td></td>
</tr>
<tr>
<td>Mass Spectrometry</td>
<td>1</td>
</tr>
<tr>
<td>Infrared</td>
<td>2</td>
</tr>
<tr>
<td>Ultraviolet/Visible</td>
<td></td>
</tr>
<tr>
<td>$^1$H NMR</td>
<td>3</td>
</tr>
<tr>
<td>$^{13}$C NMR, DEPT</td>
<td>4</td>
</tr>
<tr>
<td>COSY, HSQC, HMBC</td>
<td>5</td>
</tr>
<tr>
<td>NOESY, TOCSY</td>
<td>5</td>
</tr>
<tr>
<td>$^{15}$N, $^{19}$F, $^{29}$Si, $^{31}$P NMR</td>
<td>6</td>
</tr>
<tr>
<td>VT NMR (special topic)</td>
<td></td>
</tr>
<tr>
<td>DOSY (special topic)</td>
<td></td>
</tr>
</tbody>
</table>

**Hour Exams**

Hour exam #1  Wednesday, February 23\textsuperscript{rd}, 9:00 ~ 9:50 AM
Hour exam #2  Wednesday, March 23\textsuperscript{rd}, 9:00 ~ 9:50 AM

**Final Exam**

Monday, May 2\textsuperscript{nd}, 8:00 ~ 10:00 AM, SC 402
The final exam will be cumulative and will cover all the materials in this course.

**Grading Scheme**

Course grades will be determined by two hour-exams (100 points each), one final exam (200 points), one presentation (100 points) and homework assignments (50 points total). Your grade earned will be calculated by the following point system:

- Homework 50’
- Presentation 100’
- Exams $100’ \times 2 = 200’$
- Final Exam $200’ \times 1 = 200’$
- Total 550’
Grading Scale
The final letter grade for this course is as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>$\geq 90.00%$</td>
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<tr>
<td>A\textsuperscript{-}</td>
<td>88.00 ~ 89.99 %</td>
</tr>
<tr>
<td>B\textsuperscript{+}</td>
<td>86.00 ~ 87.99 %</td>
</tr>
<tr>
<td>B</td>
<td>78.00 ~ 85.99 %</td>
</tr>
<tr>
<td>B\textsuperscript{-}</td>
<td>76.00 ~ 77.99 %</td>
</tr>
<tr>
<td>C\textsuperscript{+}</td>
<td>74.00 ~ 75.99 %</td>
</tr>
<tr>
<td>C</td>
<td>66.00 ~ 73.99 %</td>
</tr>
<tr>
<td>C\textsuperscript{-}</td>
<td>64.00 ~ 65.99 %</td>
</tr>
<tr>
<td>D\textsuperscript{-}</td>
<td>61.00 ~ 63.99 %</td>
</tr>
<tr>
<td>D</td>
<td>52.00 ~ 60.99 %</td>
</tr>
<tr>
<td>F</td>
<td>$\leq 51.99%$</td>
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</tbody>
</table>

Class Attendance
You are expected to attend every lecture and get to class on time. Students with more than six absences from lecture will be dropped from this course. Class behavior that distracts the instructor and other students such as tardiness, leaving early, cell phone use will not be tolerated.

Missed exams
Exams will ONLY be given at the designated times. There is no make-up for missed exams. If you couldn’t attend one of the three semester hour exams, you must notify the instructor at least 24 hours in advance and provide a signed and dated written request. The score for an excused missed exam will be an average of all remaining exams (including the final adjusted to 100 points). You may only miss one exam. You will receive a score of zero if no notification is given. You will be dropped from the class if you miss two exams.

Regrades
To ask for a regrade of your examination, a written request should be submitted in no later than 48 hours after the initial date of return. Items to be regraded must be clearly marked on the front page and write a sufficient explanation of what you believe was graded incorrectly. When a regrade is requested, the entire exam may be regraded. Exams written in pencil or erasable ink will not be regraded.

Disability Services
In order to receive accommodations (academic adjustments, auxiliary aids or services) for this course, students with disabilities for this course must register with the Disability Services Office. Please contact the Disability Service Office immediately in the University Center, Suite 320 or call 859-572-6373 for more information. Verification of your disability is required in the Disability Services Office for you to receive reasonable academic accommodations. Visit the Disability Services website at www.nku.edu/~disability/.
Policy of Northern Kentucky University

Students can find policies regarding drops/adds, attendance, and Student Honor Code at [http://deanofstudents.nku.edu/codes_and_policies/codeofstudent_rights/index.php](http://deanofstudents.nku.edu/codes_and_policies/codeofstudent_rights/index.php). You are advised to read these policies as they may pertain to your progress and success. Students’ rights and responsibilities in regards to academic cheating, plagiarism, misconduct and student complaints are governed by Northern Kentucky University Student Honor code. The Honor Code is a commitment to the highest degree of ethical integrity in academic conduct, a commitment that, individually and collectively, the students of Northern Kentucky University will not lie, cheat, or plagiarize to gain academic advantage over fellow students or avoid academic requirements. In accordance with the Code of Student Rights and Responsibilities, faculty members have the right to determine actions to be taken when a student is caught cheating. Penalties for cheating can range from, but are not limited to, scores of zero on individual assignments or exams to expulsion from the University and does include failure in the course.

Policies of the Department of Chemistry at Northern Kentucky University

- All items on syllabi are subject to change by the instructor.
- Students are responsible for reading and understanding all items on the syllabi. Any items not understood must be brought to the attention of the instructor within the first two weeks of class.
- The work you will do in any course is subject to the Student Honor Code. The Honor Code is a commitment to the highest degree of ethical integrity in academic conduct, a commitment that, individually and collectively, the students of Northern Kentucky University will not lie, cheat, or plagiarize to gain an academic advantage over fellow students or avoid academic requirements.
- Cheating will not be tolerated. In accordance with the Code of Student Rights and Responsibilities, faculty members have the right to determine actions to be taken when a student is caught cheating.
- Faculty members reserve the right to dismiss or to have removed a disruptive student from their classrooms.
- Northern Kentucky University takes Instructor and Course Evaluations very seriously as an important means of gathering information for the enhancement of learning opportunities for its students. It is an important responsibility of NKU students as citizens of the University to participate in the instructor and course evaluation process. During the two weeks* prior to the end of each semester classes, you will be asked to reflect upon what you have learned in this course, the extent to which you have invested the necessary effort to maximize your learning, and the role your instructor has played in the learning process. It is very important that you complete the online evaluations with thoughtfully written comments.
  - Student evaluations of courses and instructors are regarded as strictly confidential. They are not available to the instructor until after final grades are submitted, and extensive precautions are taken to prevent your comments from being identified as coming from you.
Starting Spring semester 2011, the students who complete an evaluation for a particular course (or opt out of doing so in the evaluation) will be rewarded for their participation by having access to their course grade as soon as that grade is submitted by the instructor. On the other hand, any student who does not complete the course evaluation (or opt out of doing so in the evaluation) should expect to incur a two week delay in access to his or her course grade beyond the university's official date for grade availability.

To complete online evaluations go to http://eval.nku.edu. Click on "student login" and use the same USERNAME and PASSWORD as used on campus.

*Eight-week classes will be given one week before classes end to complete evaluations.

The content of this syllabus is subject to change at the discretion of the instructor.

Last revised: January 5th, 2011