CHEM:3120 Analytical Chemistry II
Syllabus – Spring 2020

I. General Information:

Instructor: Prof. David McCurdy
W239 CB
Office Phone: 319-335-4867
E-Mail: david-mccurdy@uiowa.edu

Teaching Assistants: Christian Haas
E-mail: christian-haas@uiowa.edu
Office Hours: T/Th 10:30-11:30 AM

Chenghao Geng
E-mail: chenghao-geng@uiowa.edu
Office Hours: M-Th 2:30 – 3:30 PM

DEO: Prof. Leonard MacGillivray, Department of Chemistry; Office: E331 CB; Phone:
335-1361/335-1350

Course WebSite: Class Information, lecture slides and pictures, alternate reading information,
problems/solutions and grade points are available on the class ICON site. The web
address is http://icon.uiowa.edu. Announcements will also be posted on this site, so
it is encouraged that you check the site regularly.

Office Hours: Office hours are posted on my office door and also on the ICON web site.

Tuesday: 10 AM – 11:30 AM in W244 CB
Wednesday: 12:30 PM – 2:00 PM in W244 CB
Other times by appointment.

Course Schedule:

Lecture: Section 000A 10:30-11:20 AM MWF W228CB
Discussion: Section 0002 09:30-10:20 AM M C129 PC
Section 0003 02:00-02:50 PM T C208 PBB
Section 0004 11:30 AM -12:20PM W C139 PC

Course Description: This course is a survey of modern chemical instrumental techniques with focus on
spectroscopy, chemical separations, and mass spectrometry. Specific topics will
include important introductory ideas, atomic spectroscopy, molecular spectroscopy,
gas chromatography, liquid chromatography, capillary electrophoresis, and mass
spectrometry.

Course Pre-requisites: CHEM 1120 and MATH:1460 (Calculus for Biological Sciences) or MATH 1860
(Calculus II); PHYS:1511 (College Physics I) or PHYS:1611 (Introductory Physics I).

Required Materials:

Brooks-Cole, 2007, ISBN:978-0-495-01201-6. Edition 5 can be used if desired, as it has quite similar
content. Older editions and international versions are discouraged as they contain errors and often
have different material. Your instructors and class TA will be providing references to the 6th edition
only. If using an older edition, it is your responsibility to determine the corresponding reading and
problems in that book. The detailed table of contents for the 6th edition will be posted on the ICON
class site under general course information.
**Additional reading assignments:** Assignments will be made from material other than the text. It will either be provided as a handout, posted as a pdf file on the ICON web site, provided through a web link, or perhaps obtained through the chemical literature by your own effort.

**Calculator:** A hand-held, non-programmable, scientific calculator will be necessary for exams and quizzes. The instructor will not be responsible for bringing “loaners” for your use.

**Photocopy Costs:** Occasional literature assignments may be made in which you may be responsible for the costs of photocopying a research or review article.

**Course Structure:**

The class consists of three components. Attendance is considered necessary as the material presented in class will be derived from a variety of sources and the text will not always contain everything covered. Not all lectures will be on Powerpoint; many will emphasize problem-solving and most certainly will include discussion. It is recommended you devote about 6 hours per week (3 credits x 2 study hours per credit) for your out of class activities. This should include reading recommended materials, working on homework assignments, reviewing class notes, and spending time on problem-solving activities.

1. **Lectures:** Professor McCurdy – Class notes will often be written on the board, ideas not always described in the text will be presented, and questions will be asked. Be prepared to discuss ideas.

2. **Discussion Sessions:** Prof. McCurdy and graduate TA -- Exercises in which you will participate, discuss and critically think will be done in these sessions.

3. **Homework:** Homework will be assigned to correlate with lecture topics. These assignments will be posted on the class ICON site. Announcements in lecture will also refer to the assignments (can be both text problems or worksheet postings on ICON) as well as due dates correlating with them.

4. **Examinations:** Professor McCurdy with input from TAs -- The exams will not likely have multiple choice questions. There will be short answer, problems and discussion topics included. An example will be provided on the ICON site prior to the first exam. Practice exams will not be posted.

**II. Course Objectives:**

The objectives of this class include the development of a fundamental understanding of separations, spectroscopy, and mass spectrometry. More details on specific objectives related to the diverse instrumental topics covered will be posted on the course ICON site. The overarching objectives of the class are:

- Understand the background theory, fundamental principles and relevant terminology associated with separations, spectroscopy, and mass spectrometry.
- To understand and critically evaluate the utility, strengths, weaknesses and limitations of common, modern separation, spectroscopic and mass spectrometric instrumentation.
- To integrate the theory of modern instrumentation with the practical ways that modern instruments are used.
- To understand and be able to solve qualitative and quantitative problems with familiar and unfamiliar concepts, as applicable with modern instrumentation.
- To understand how mathematics, statistics, and the basic concepts of chemistry, physics and electronics are fundamentally important to intelligent use of modern instrumentation, as well as to practice the application of these ideas.
III. Lecture Information:

Course Coverage: Topics will be covered in the approximate sequence below, as time permits. You instructor reserves the right to modify content and coverage based on student needs and timing. Most certainly every topic in the book cannot be covered in a class such as this, so please pay close attention to the recommended reading assignments associated with each topic presented.

- Reading assignments will be made from the text. It will be expected you read these sections.
- The lecture will explore and expand upon topics from the text reading assignments. Additional information will be presented that may not always be in the text, making class attendance crucial.
- Powerpoint slides shown in lecture will be posted on the ICON site. As many notes will not be presented through Powerpoint and often driven by class discussion, these will not necessarily be provided through the ICON site. Students will be responsible for this information.
- A more detailed calendar of specific reading assignments, goals, homework, discussion activities, exams and exam coverage will be maintained on the ICON site and announced in lecture. The general areas covered in this course will include the major sections as listed below. An approximation of the number of lectures spent is also included.

<table>
<thead>
<tr>
<th>Unit #</th>
<th>Topic</th>
<th>Approx. # of Lectures</th>
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<tbody>
<tr>
<td>1</td>
<td>Introductory Ideas (Chapters 1-5)</td>
<td>8</td>
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<tr>
<td></td>
<td>Overview of Instrumentation</td>
<td></td>
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<tr>
<td></td>
<td>Electronics and Chemical Instrumentation</td>
<td></td>
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<td></td>
<td>Signals, Noise and Calibration</td>
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<tr>
<td>2</td>
<td>Separations (Chapters 26-28, 30)</td>
<td>14</td>
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<tr>
<td></td>
<td>Introduction to Chromatographic Separations</td>
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<td></td>
<td>Gas Chromatography</td>
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<td></td>
<td>Liquid Chromatography</td>
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<td></td>
<td>Electrophoresis (capillary)</td>
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<tr>
<td>2</td>
<td>Spectroscopy (Chapters 6-11; 13-18)</td>
<td>14</td>
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<tr>
<td></td>
<td>Interaction of Light and Matter</td>
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<td>Optical Components and spectrometers</td>
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<tr>
<td></td>
<td>Atomic Spectroscopy</td>
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<td></td>
<td>Molecular Spectroscopy</td>
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<tr>
<td></td>
<td>UV-VIS Spectrophotometry</td>
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<td>Luminescent Spectroscopy</td>
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<td></td>
<td>Infrared and Raman Spectroscopy</td>
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<tr>
<td>4</td>
<td>Mass Spectrometry (Chapter 20/additional reading)</td>
<td>4</td>
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<tr>
<td></td>
<td>Molecular Mass Spectrometry</td>
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<td></td>
<td>Biochemical Mass Spectrometry</td>
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Lecture Exams: There will be 3 lecture examinations given as in-class exams. Each exam will be worth 100 points. The exams will be written for 50 minutes. Exams will be closed book and note. The following is a tentative schedule of the days set aside for examinations.

Exam 1: February 17, 2020 (Wednesday)
Exam 2: March 27, 2020 (Friday)
Exam 3: April 27, 2020 (Monday)
• Re-grade requests must be submitted within 1 week after grading evaluations have been made available through the Chemistry Center. Make sure they are time stamped when turning them in.

**Final Exam:** A comprehensive final exam worth 150 points will be given at a time and place to be determined.

• If you have any exam conflicts, please let them be known to your instructor more than 1 week in advance.

**Class Assignments:** Assignments involving reading, homework, and literature work will be given regularly. You will be expected to complete them on time to allow more active and meaningful participation in the class.

• Homework is important! It contributes up to 150 points to your grade and is also important in terms of preparation for quizzes and exams.
• Not all assignments will be awarded point contributions to your grades.
• Complete all assignments in ink or as a printed version of electronic answers (MS word, …)
• *No late assignments will be accepted.* Due dates will be announced in advance and enforced.
• Assignments and announcements will be announced at the beginning of the class period and on the class ICON site. The instructor assumes no responsibility for communicating information presented in lecture for tardy individuals or absences.
• Failure to turn in homework that is collected will have a bearing on borderline grades.
• It is particularly important to prepare the pre-class reading IN ADVANCE of the classroom discussion. In many cases, advance reading will mean the difference between clear comprehension and utter confusion.

**Quizzes:** Routine quizzes are not planned but will be given if I deem that class preparation is inadequate, or poor course citizenship is exhibited.

**Attendance and Participation:** You are expected to attend lecture and arrive on time. [An old adage suggests that being on time is 10 minutes early – Being late is arriving on time]. Attendance and participation in lecture and discussion periods will be noted and will be considered in grade determinations (both through points awarded in discussion and in grade borderline considerations). Habitually late arrival will be noted and will be considered an absence.

**Make-Up Exams:** Makeup exams MUST be scheduled BEFORE the original exam starts and taken within 48 hours of the originally scheduled exam time. Additional accommodations will be provided if warranted. No credit will be given for missed exams or quizzes without prior instructor notification and approval.

**IV. Discussion Section:**

The discussion sections are limited to about 20 students and add a more personal component to the lectures. These sessions are designed to provide students to ask questions, gain problem solving experience and strategies, and to reinforce/add additional important ideas to complement the lecture coverage. They will contribute 150 points to your overall grade. Graduate student TAs will facilitate learning teams and lead problem-solving strategies.

• **Attendance and Participation are required** throughout the semester.
• During exam weeks the discussion sections will review material to allow an additional opportunity to ask questions. Use this opportunity to your advantage.
• You should attend the discussion to which you are registered. You must receive permission in advance to attend an alternate section. Requests to attend an alternate session must be considered university-approved reasons.
• Points will be awarded for participation and performance on graded discussion activities. Some problems done in the discussion session will be collected and graded.
• You should bring notes and a text to the sessions, though some exercises will be done with closed text and notes.
• A maximum of 150 discussion points can be earned through the semester.
• Your lowest 2 review activity scores will not be counted for the discussion contribution to your grade.

V. Course Grade Summary:

The overall breakdown of grade points will be as follows.

Examinations: 300 points maximum
Homework and Projects: 150 points maximum
Discussion Activities: 150 points
Final Examination: 150 points maximum
Total: 750 points maximum

Letter grades will be assigned by calculating the percentage of points earned during the semester. The scale used to assign letter grades is shown below. The +/- grading scale will be used and exceptional performances will earn an A+. The instructor reserves the right to lower the grading scale, but this should not be expected. The grading scale will never be raised.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Grade</th>
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<tbody>
<tr>
<td>88.0 - 100</td>
<td>A</td>
</tr>
<tr>
<td>76.0 - 87.9</td>
<td>B</td>
</tr>
<tr>
<td>64.0 - 75.9</td>
<td>C</td>
</tr>
<tr>
<td>52.0 - 63.9</td>
<td>D</td>
</tr>
<tr>
<td>0 – 51.9</td>
<td>F</td>
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VI. Course Policies and Reminders:

*** Your instructors reserve the right to deduct a point for using the term “machine” to refer to an instrument.

*** No unauthorized photography or recording! You should be taking notes in class and discussion. Point deductions may be assessed for violation of this policy.

*** No late homework assignments will be accepted. Make-ups will be granted only at the instructor’s discretion and only for reasonable excuses.

** No makeup opportunities for unexcused absences. If you must miss discussion or an exam, please fill out the “Excused Absence Form” and submit it via email.

*** All mathematical work and assumptions used when solving a problem must be shown to receive credit. Mark all answers clearly.

*** Solutions keys for homework and exams will be posted on the class ICON site.

*** Please stow and silence cell phones during class.

*** Refrain from working with electronic devices during class for non-related class purposes. It disturbs those around you. If you do, sit in the rear of the room. If these activities disturb another student, you will be asked to leave.

*** Cramming class material will not develop necessary proficiency to allow completion of the exams.
***A NOTE ON CLASS COLLABORATION:*** Assignments turned in for credit must represent your work and understanding, as well as being written in your own words. Do not share your completed work with others or as others to see their completed assignments. These are all considered academic misconduct and will be reported to the Dean of Students.

***DATE and TIME of the Final Exam:*** The final exam date and time will be announced by the registrar roughly 4 weeks into the semester. This information will be shared through ICON when known. Do not plan your end of semester travel plans until the schedule is made public. It is your responsibility to know the date, time and place of the final exam and to be sure there are no conflicts.

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University of Iowa and College of Liberal Arts and Sciences (CLAS)
Teaching Policies & Resources

**Administrative Home**
The College of Liberal Arts and Sciences is the administrative home of this course and governs matters such as the add/drop deadlines, the second-grade-only option, and other related issues. Different colleges may have different policies. Questions may be addressed to 120 Schaeffer Hall, or see the CLAS Academic Policies Handbook.

**Electronic Communication**
University policy specifies that students are responsible for all official correspondences sent to their University of Iowa e-mail address (@uiowa.edu). Faculty and students should use this account for correspondence (Operations Manual, III.15.2. Scroll down to k.11).

**Accommodations for Disabilities**
A student seeking academic accommodations should first register with Student Disability Services and then meet with the course instructor privately in the instructor's office to make particular arrangements. See https://sds.studentlife.uiowa.edu/ for more information.

**Nondiscrimination in the Classroom**
The University of Iowa is committed to making the classroom a respectful and inclusive space for all people irrespective of their gender, sexual, racial, religious, or other identities. Toward this goal, students are invited to optionally share their preferred names and pronouns with their instructors and classmates. The University of Iowa prohibits discrimination and harassment against individuals on the basis of race, class, gender, sexual orientation, national origin, and other identity categories set forth in the University’s Human Rights policy. For more information, contact the Office of Equal Opportunity and Diversity, diversity@uiowa.edu, or visit diversity.uiowa.edu.

**Academic Honesty**
All students taking CLAS courses have, in essence, agreed to the College's Code of Academic Honesty: "I pledge to do my own academic work and to excel to the best of my abilities, upholding the IOWA Challenge. I promise not to lie about my academic work, to cheat, or to steal the words or ideas of others; nor will I help fellow students to violate the Code of Academic Honesty." Any student committing academic misconduct is reported to the College and placed on disciplinary probation or may be suspended or expelled (CLAS Academic Policies Handbook).

**CLAS Final Examination Policies**
The date and time of every final examination is announced by the Registrar generally by the fifth week of classes. No exams of any kind are allowed during the last week of classes. All students should plan on being at the UI through the final examination period. It is the student's responsibility to know the date, time, and place of the final exam.

**Making a Suggestion or a Complaint**
Students with a suggestion or complaint should first visit with the instructor and then with the departmental DEO. Complaints must be made within six months of the incident (CLAS Academic Policies Handbook).

**Understanding Sexual Harassment**
Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff. All members of the UI community have a responsibility to uphold this mission and to contribute to a safe environment that enhances learning. Incidents of sexual harassment should be reported immediately. See the Office of the Sexual Misconduct Response Coordinator for assistance, definitions, and the full University policy.
Reacting Safely to Severe Weather
In severe weather, class members should seek appropriate shelter immediately, leaving the classroom if necessary. The class will continue if possible when the event is over. For more information on Hawk Alert and the siren warning system, visit the Public Safety website.

These CLAS policy and procedural statements have been summarized from the web pages of the College of Liberal Arts and Sciences and The University of Iowa Operations Manual.

Diligence is the mother of good luck.

--------- Benjamin Franklin