## Change Course (Major) and Drop Course Proposal

### Submitted By:
- **Department:** Chemistry and Biochemistry
- **Prepared by:** William Simpson
- **Email:** ffwrs@uaf.edu
- **Contact:** William Simpson

### College/School:
- **CNSM**

### Phone:
- 474-7235

### Faculty Contact:
- William Simpson

### 1. COURSE IDENTIFICATION:
- **Dept:** CHEM
- **Course #:** 332
- **No. of Credits:** 3
- **Course Title:** Physical Chemistry

### 2. ACTION DESIRED:
- **Change Course [X]** If Change, indicate below what change.
- **Drop Course [ ]**

### NUMBER

### PREREQUISITES

### CREDITS (including credit distribution)
- **4**

### CROSS-LISTED
- **Dept.**
- **Course #**

### STACKED (400/600)
- **Dept.**
- **Course #**

### OTHER (please specify)

### 3. COURSE FORMAT

**NOTE:** Course hours may not be compressed into fewer than three days per credit. Any course compressed into fewer than six weeks must be approved by the college or school's curriculum council. Furthermore, any core course compressed to less than six weeks must be approved by the core review committee.

### COURSE FORMAT:
- **Lecture + Laboratory Section**

### OTHER FORMAT (specify)
- Mode of delivery (specify lecture, field trips, labs, etc.)

### 4. COURSE CLASSIFICATIONS:
(undergraduate courses only. Use approved criteria found on Page 10 & 17 of the manual. If justification is needed, attach on separate sheet.)

- **H = Humanities**
- **N = Natural Science**
- **S = Social Sciences**

Will this course be used to fulfill a requirement for the baccalaureate core? **YES [X] NO**

If YES, check which core requirements it could be used to fulfill:
- **O = Oral Intensive, Format 6**
- **W = Writing Intensive, Format 7**
- **Natural Science, Format 8**

### 5. COURSE REPEATABILITY:
- **Is this course repeatable for credit? [ ]**
- **YES [X] NO**

**Justification:** Indicate why the course can be repeated (for example, the course follows a different theme each time).

**How many times may the course be repeated for credit?**

**If the course can be repeated with variable credit, what is the**

---

**Dean's Office**

**College of Natural Science & Mathematics**

**Received**

**OCT - 2 2008**

**FORMAT 2**

Submit originals and one copy and electronic copy to Governance/Faculty Senate Office. See http://www.uaf.edu/uafgov/faculty/cd for a complete description of the rules governing curriculum & course changes.
6. CURRENT CATALOG DESCRIPTION AS IT APPEARS IN THE CATALOG: including dept., number, title and credits

CHEM F332 Physical Chemistry

3 Credits Offered Spring

Kinetic theory of gases, chemical kinetics, atomic and molecular structure, and spectroscopy. Special fees apply. Prerequisites: CHEM F331 or permission of instructor. (3+0)

7. COMPLETE CATALOG DESCRIPTION AS IT WILL APPEAR WITH THESE CHANGES: (Underline new wording strike-through old wording and use complete catalog format including dept., number, title, credits and cross-listed and stacked.) PLEASE SUBMIT NEW COURSE SYLLABUS. For stacked courses the syllabus must clearly indicate differences in required work and evaluation for students at different levels.

CHEM F332 Physical Chemistry

3 ½ Credits Offered Spring

Kinetic theory of gases, chemical kinetics, atomic and molecular structure, spectroscopy, and statistical mechanics. Course teaches these concepts using both lecture and laboratory instruction. Special fees apply. Prerequisites: CHEM F331 or permission of instructor. (3+0)

8. IS THIS COURSE CURRENTLY CROSS-LISTED?

YES/NO NO If Yes, DEPT __________ NUMBER ________

(Requires written notification of each department and dean involved. Attach a copy of written notification.)

9. GRADING SYSTEM:

LETTER: X PASS/FAIL: ________

10. ESTIMATED IMPACT

WHAT IMPACT, IF ANY, WILL THIS HAVE ON BUDGET, FACILITIES/SPACE, FACULTY, ETC.

No impact. This is a re-structuring of the physical/analytical curriculum.

11. LIBRARY COLLECTIONS

Have you contacted the library collection development officer (ffklj@uaf.edu, 474-6695) with regard to the adequacy of library/media collections, equipment, and services available for the proposed course? If so, give date of contact and resolution. If not, explain why not.

No X Yes ________ Library collection already covers course content

12. IMPACTS ON PROGRAMS/DEPTS:

What programs/departments will be affected by this proposed action? Include information on the Programs/Departments contacted (e.g., email, memo)

This change impacts the Department of Chemistry and Biochemistry (Chair Prof. John Keller, fjiwk@uaf.edu)

13. POSITIVE AND NEGATIVE IMPACTS

Please specify positive and negative impacts on other courses, programs and departments resulting from the proposed action.

This change is a part of a reorganization of lecture and laboratory experiences in the undergraduate chemistry degree programs. Currently, the physical chemistry laboratory (CHEM434) is a separate course from the lecture, which gives students less hands-on experience with the concepts addressed in
the class. We propose to integrate laboratory exercises into the lecture class to ground the theoretical concepts from the course in reality (through laboratory experimentation). To give proper credit, we have increased the credits to four (from three). To maintain total credit hours, we also propose to reduce the credit hours in CHEM434 from 3 to 2. Thus, there are no negative impacts and the change promises to give a better, more integrated, laboratory experience to chemistry majors.

JUSTIFICATION FOR ACTION REQUESTED

The purpose of the department and campus-wide curriculum committees is to scrutinize course change and new course applications to make sure that the quality of UAF education is not lowered as a result of the proposed change. Please address this in your response. This section needs to be self-explanatory. If you ask for a change in # of credits, explain why; are you increasing the amount of material covered in the class? If you drop a prerequisite, is it because the material is covered elsewhere? If course is changing to stacked (400/600), explain higher level of effort and performance required on part of students earning graduate credit. Use as much space as needed to fully justify the proposed change and explain what has been done to ensure that the quality of the course is not compromised as a result.

The Department of Chemistry and Biochemistry is proposing to reorganize the junior/senior level curriculum for physical and analytical chemistry. In the past, upper-level laboratory sections were separated from their lecture course, which led to a number of issues. First, we feel that parallel laboratory investigations that are paired with lecture material reinforce the lecture material and “grounds” the lecture in physical reality. Second, students will often not take lecture and laboratory sections in the proper order, forcing the instructor to duplicate material. Third, we feel that there was one benefit of the past arrangement, which we propose to maintain. The laboratory sections that are taken in the senior year gave students a “capstone experience” where they synthesized learning both from the associated lecture and other courses. We propose to maintain this experience and expand its synthetic nature by integrating both physical and analytical chemistry concepts into a two-semester writing-intensive capstone laboratory experience. To maintain overall credit numbers, we have shifted one credit from each of the laboratory courses to the lecture courses (emphasizing that some of the laboratory workload in the current senior level courses will be moved to the junior year). The overall changes are summarized as follows, and we then discuss this specific change (to this course) below:

Chem 212 (Quantitative Analysis Lecture) – integrate lab section, increase credits 3 to 4
Chem 313 (Quantitative Analysis Laboratory) – drop course because it is now a part of 212, decreasing credits from 2 to zero.
Chem 331 (Physical Chemistry I) – add lab section, increase credits from 3 to 4
Chem 332 (Physical Chemistry II) – add lab section, increase credits from 3 to 4
Chem 412 (Instrumental Analysis) – add lab section, increase credits from 3 to 4.
Chem 434 (Physical Chemistry Laboratory) – rename as Integrated Physical / Analytical Laboratory, decrease credits 3 to 2
Chem 413 (Instrumental Laboratory) – rename as Integrated Physical / Analytical Laboratory, decrease credits 3 to 2

Specific justification for this change:

We are requesting increasing the credits in Chem 332 (Physical Chemistry I) from 3 to 4 because we are adding a laboratory section to the course. In parallel, we decrease the credits in Chem 413 (Instrumental Laboratory) from 3 to 2. Thus, there is no net change in the amount of laboratory experience that a student will experience; these experiences are simply better integrated with the lectures. We have also enhanced the course’s use of computational chemistry and teaching of statistical mechanics and therefore have moved kinetics and kinetic theory of gases to the first semester (Chem331).
APPROVALS:

Signature, Chair, Date 10-2-08
Program/Department of:

Signature, Chair, College/School Curriculum Council for: Date 10/14/08

Signature, Dean, College/School of: CNM Date 10/15/08

Signature of Provost (if applicable)
Offerings above the level of approved programs must be approved in advance by the Provost.

ALL SIGNATURES MUST BE OBTAINED PRIOR TO SUBMISSION TO THE GOVERNANCE OFFICE.

Signature, Chair, UAF Faculty Senate Curriculum Review Committee Date

ADDITIONAL SIGNATURES: (If required)

Signature, Chair, Date
Program/Department of:

Signature, Chair, College/School Curriculum Council for: Date

Signature, Dean, College/School of: Date
Chem 332  

Course Overview  

Physical Chemistry II  

Fall 2009

Instructor  Prof. William R. Simpson  
Office  NSF 186 and IARC 334, Tel: 474-7235  
Email  ffwrs@uaf.edu  
Class meeting  Monday, Wednesday, and Friday 10:30 - 11:30 AM, REIC 203  
Laboratory  TBD – 3 hours  
Section  
Office hours  After class; Monday, Wednesday and Friday 1:30 PM – 2:30 PM, and by appointment  
Text  “Physical Chemistry” by Engel and Reid  
Handouts for laboratory section

Course Overview: Chemistry 332 is the second semester of a two-semester series in physical chemistry. It follows Chemistry 331.

Prerequisites: Chem 331- the first semester of this class; Math 202 - the 3 semester sequence in differential and integral calculus, vector algebra, and partial differential equations; and Phys 104 or 212 - one year of science major general physics.

Course structure: The course follows your text in the order described on the attached schedule of topics. During Monday and Wednesday classes, I will lecture on the material in the book. Reading the book before the lectures will be important for following and understanding the lectures. The Friday classes are a combination of lecture and in-class quizzes. These Friday quizzes are a very important part of the course as they will help you to stay current with and to understand the material of the course. The course also has a laboratory section to give physical examples of the concepts you learn in class.

Grading Structure (points): Your course grade will be based on the total points of the hour exams, the final exam, the quiz scores, reading questions, and possibly extra credit from attendance at and participation in demonstration laboratories and reading questions. Material assigned in readings, in lecture, or in homework problems may appear on an exam. The maximum number of points for each is given below:

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hour exams 100 pts each</td>
<td>300</td>
</tr>
<tr>
<td>Final exam</td>
<td>100</td>
</tr>
<tr>
<td>Quizzes</td>
<td>80</td>
</tr>
<tr>
<td>Reading questions</td>
<td>20</td>
</tr>
<tr>
<td>Laboratory</td>
<td>150</td>
</tr>
<tr>
<td>Total</td>
<td>650</td>
</tr>
<tr>
<td>XC: Reading questions</td>
<td>+10</td>
</tr>
</tbody>
</table>

Exams: The exams will be given during class, and will be one hour in length. You are permitted to use a calculator, a unit sheet (distributed with the exams), and a half sheet of
paper (8.5"x5.5") containing only formulas. You should continually prepare this sheet as you study the material. Don't copy your friend's sheet. Preparing and organizing material is essential. I will look at the sheet during the exam and may collect the sheet. Chemistry Department regulations require that any student caught cheating on graded work will be assigned a course grade of F. Course drop forms will not be signed in these cases. Homework, quiz, and exam solutions will be posted on the web in the Blackboard system.

Make up exams: Make-up exams will be allowed if you have a good reason. If you anticipate an absence (work commitments, intercollegiate sports), talk to me before the exam to make arrangements. If the absence is unexpected (illness, family or personal difficulties), talk with me at the earliest possible opportunity.

Students with disabilities: Students with documented disabilities who may need reasonable academic accommodations should discuss these with me during the first two weeks of class. You will need to provide documentation of your disability to Disability Services in the Center for Health and Counseling, 474-7043, TTY 474-7045

Homework: Physical chemistry is a hard class. I see three ways that the class is hard: 1) Mechanically: It can be hard to calculate the correct answer because of algebra complexities or unit conversions. Some of your homework problems are designed to hone these skills. A solid mathematics background also helps. 2) Conceptually: You will have to find the right technique to solve a problem or identify the formula appropriate for the problem. 3) Theoretically: Many of the central concepts of physical chemistry reappear throughout the class. Therefore, seeing parallels between what at first appear to be different problems assists you in mastering the material of physical chemistry. This is the true power of physical chemistry. For example, in general chemistry, you learned about equilibrium constants and also about vapor pressures of gases. In this class, you will discover that both processes are described by the same theory.

Homework and in-class quizzes are critical aspects of learning these three parts of physical chemistry. Every week you will be assigned 3 to 6 homework exercises. These homework exercises are not graded, but you will be provided with homework keys (posted on the web). If you attempt a problem but don't get an answer, see me for help. A few of these exercises are selected to improve your mechanical skills and also help you to find the right formula to apply to a problem. Many of the problems will be conceptual in nature. These questions address the theoretical connections between various physical chemistry problems.

Quizzes: The quizzes will be given during class, and will be about 15 minutes in length. You are permitted to use a calculator, and a formula / unit sheet (distributed with the quiz). The formula / unit sheet will have all appropriate formulae as well as numerical values for constants and unit conversions. The quizzes will be on all Fridays except on the Friday during the week of an hour exam. See the calendar for exact dates. The purpose of the quiz is to provide a frequent check on learning progress. Doing the homework diligently is the best way to assure good grades on the quizzes, and past experience has shown that good quiz grades translate to good course grades. There will be no makeup quizzes, but your two lowest quiz grades will be dropped. Answers to the quizzes will be posted on the website.

Working in groups: While working on your homework and/or preparation for Friday quizzes, you may work in groups. In fact, working in groups usually results in faster and deeper learning. Whether you work in a group or alone, you must take the exams and quizzes alone. Copying the solution of another student is not working in a group and will lead to a
hole in your understanding that will appear in your exam and quiz performance. My advice is to work the homework and study in groups but don’t cheat yourself.

**Reading Assignments and Reading Questions:** I will assign the reading (on the order of 10 pages) for the next class through the blackboard web system within a couple hours of completion of a class. Doing this reading as preparation for the class is critical to being able to follow the material in the class, and allows the lecture to reinforce your reading. Following the lecture, the problem sets then further the learning, and the weekly quiz provides frequent checks. At most classes, I will start the class with a brief (2-minute) daily question on the reading that you completed in preparation for the class. There will be 30 of these questions, each graded as one point. Twenty of these points will count towards the normal point total, and up to 10 points will be extra credit to reward you for careful reading of the book. Therefore, I list 20 points as in the normal points and 10 points of extra credit for the total 30 points of reading questions.

**Laboratories:** As a part of this course, we will carry out a set laboratory experiments that will help you to see physical examples of the concepts you are learning in class. A part of the laboratory time includes a recitation on the week’s material, and the weeks of exams, we will have a review session in place of the laboratory. The laboratory experiments are graded on participation in the laboratory, your laboratory notebook, and your written laboratory reports.

The exams will be given on the following dates: see the calendar for more detailed information. Exams are generally on Wednesday, and quizzes are on Friday.

<table>
<thead>
<tr>
<th>Exam</th>
<th>Material Included</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>weeks 0-3</td>
<td>11 Feb (Wed)</td>
</tr>
<tr>
<td>2</td>
<td>weeks 4-7</td>
<td>10 Mar (Wed)</td>
</tr>
<tr>
<td>3</td>
<td>weeks 8-12</td>
<td>14 Apr (Wed)</td>
</tr>
<tr>
<td>Final</td>
<td>40% weeks 13-16, 60% cumulative</td>
<td>7 May (Fri)</td>
</tr>
</tbody>
</table>

Tentative Grade Scale (If you get at least 90%, you are guaranteed an “A”. I may elect to set the grade cutoffs lower, but we will not set them higher.) I will not be using +/- grading.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>90 %</td>
</tr>
<tr>
<td>B</td>
<td>80 %</td>
</tr>
<tr>
<td>C</td>
<td>70 %</td>
</tr>
<tr>
<td>D</td>
<td>60 %</td>
</tr>
</tbody>
</table>

**Important dates:**

- Last day for 100% of tuition and fee refund ................................Friday, 23 Jan
- Last day for drops (course does not appear on record), 50% tuition refund ..Friday, 30 Jan
- Last day for withdrawals (W appears on academic record) .........................Friday, 12 Mar
- Final Exam (10:15-12:15) .............................................................................Friday, 7 May
Summary of Resources:
Faculty—Bill Simpson, NSF 186, 474-7235, ffwrs@uaf.edu
Chem331 home page: log into the blackboard system: http://classes.uaf.edu/ —syllabus, sample exams and solutions, solutions to quizzes, homework solutions, email to faculty, links to other sites.

Tentative Schedule of topics (see blackboard website for detailed reading assignments):

<table>
<thead>
<tr>
<th>Week</th>
<th>Chapter</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>11</td>
<td>Introduction to Quantum Theory</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
<td>Quantum Theory -- Behavior of small systems</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>Quantum Concepts -- mathematical description</td>
</tr>
<tr>
<td>3</td>
<td>12,13</td>
<td>Quantum Applications</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>Atomic Structure</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>Molecular Electronic Structure</td>
</tr>
<tr>
<td>6</td>
<td>15</td>
<td>Molecular Structure and Symmetry</td>
</tr>
<tr>
<td>7</td>
<td>15</td>
<td>Molecular Structure and computational chemistry (hyperchem)</td>
</tr>
<tr>
<td>8</td>
<td>16</td>
<td>Rotational- Vibrational Spectroscopy</td>
</tr>
<tr>
<td>9</td>
<td>---</td>
<td>Spring Break -- No Classes</td>
</tr>
<tr>
<td>10</td>
<td>16,17</td>
<td>Vibrational and Electronic Spectroscopy</td>
</tr>
<tr>
<td>11</td>
<td>17</td>
<td>Electronic Spectroscopy and Lasers</td>
</tr>
<tr>
<td>12</td>
<td>19</td>
<td>Statistical Mechanics</td>
</tr>
<tr>
<td>13</td>
<td>20</td>
<td>Statistical Mechanics</td>
</tr>
<tr>
<td>14</td>
<td>1,24,25</td>
<td>Molecular motion and Kinetics</td>
</tr>
<tr>
<td>15</td>
<td>27</td>
<td>Kinetics and Reaction Dynamics</td>
</tr>
<tr>
<td>16</td>
<td>---</td>
<td>Review for Final</td>
</tr>
</tbody>
</table>

Tentative schedule of laboratories (see blackboard website for details):

<table>
<thead>
<tr>
<th>Week</th>
<th>Lab</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>Introduction to lab and safety</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Computational Chemistry: Introduction</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>The Spectrum of a One-Electron Atom: Hydrogen</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Review session for Exam 1</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>Spectra of multi-electron atoms: Li and Ne</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>Comp. Chemistry: Electronic potential energy curves</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>The Rotation-Vibration Spectra of diatomic molecules</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Review session for Exam 2</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Spring Break</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
<td>The Spectrum of Conjugated Dyes</td>
</tr>
<tr>
<td>11</td>
<td>7</td>
<td>Fluorescence of Iodine Vapor</td>
</tr>
<tr>
<td>12</td>
<td>8</td>
<td>Statistical mechanics and heat capacities</td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>Review for Exam 3</td>
</tr>
<tr>
<td>14</td>
<td>9</td>
<td>Computational Chemistry: Statistical mechanics</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>Review for Final Exam</td>
</tr>
</tbody>
</table>