**Course Change Proposal**  
**Form A**

<table>
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<tr>
<th>Academic Group (College):</th>
<th>Academic Organization (Department):</th>
<th>Date:</th>
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<tbody>
<tr>
<td>NSM</td>
<td>Chemistry</td>
<td>3-15-2011</td>
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<thead>
<tr>
<th>Type of Course Proposal:</th>
<th>Department Chair:</th>
<th>Submitted by:</th>
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<tbody>
<tr>
<td>New_X Change Deletion</td>
<td>Dr. Linda Roberts</td>
<td>Benjamin Gherman</td>
</tr>
</tbody>
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<tr>
<th>Does this course fulfill a requirement for single-subject or multiple subject credential students?</th>
<th>For Catalog Copy:</th>
<th>CCE (Extension):</th>
<th>Semester Effective:</th>
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<tr>
<td>Yes_X No</td>
<td>Yes_X No</td>
<td>Yes_X No</td>
<td>Fall_X Spring, 2011</td>
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This course replaces experimental course Subject Area (prefix) and Catalog Nbr (course number):  
If changing an existing course, should new version be considered a repeat of the original version? If so, the same Course ID will be maintained. If not, a new Course ID will be assigned. Note: In PeopleSoft terminology, the Course ID is the unique system identifier, not the Catalog Nbr.

<table>
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<tr>
<th>Subject Area (prefix) &amp; Catalog Nbr (course no.):</th>
<th>Title:</th>
<th>Units:</th>
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<tbody>
<tr>
<td>Change from:</td>
<td></td>
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<tr>
<td>Subject Area (prefix) &amp; Catalog Nbr (course no.):</td>
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<td>Change to:</td>
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<tr>
<td>Chem 145</td>
<td>Applications of Computational Chemistry</td>
<td>3</td>
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**JUSTIFICATION:**

Chem 145 is being created as a cross-listing to Chem 245. The Applications of Computational Chemistry course provides content of significant applicability to undergraduates as well as graduate students. The prerequisites for both groups of students are the same. Cross-listing also provides the benefit to undergraduate students of having an additional 100-level course which they can choose to complete their elective requirement for the BA and BS degrees in chemistry. In contrast to Chem 145, graduate students in the cross-listed Chem 245 course will be required to complete a research project to be due near the conclusion of the course. (This research project involves the study of a computational method not discussed in the course sessions. The research project will be due as both a written report and as an oral presentation to the class.)

**NEW COURSE DESCRIPTION:** (Not to exceed 80 words, and language should conform to catalog copy. See http://www.csus.edu/umanual/acad.htm - Guidelines for Catalog Course Description)

**CHEM 145. Applications of Computational Chemistry.** Brief introduction/background in computational theory, with emphasis on chemical/biochemical applications. Demonstration/instruction of widely used modeling/computational software. Covering techniques including molecular mechanics, semi-empirical methods, and *ab initio* methods. Application of computational methods to thermodynamics, kinetics, spectra, electrochemistry, molecular properties. Chem 245 students will complete an additional research project beyond that expected of students in Chem 145. Lecture three hours. **Prerequisite:** Chem 140A & Chem140B, or Chem142, or instructor permission. Units: 3.0. Offered alternate years.

**Note:**

**Prerequisite:** Chem 140A & Chem140B, or Chem142, or instructor permission.

**Enforced at Registration:** Yes_X No

**Corequisite:**

**Enforced at Registration:** Yes_X No

**Graded:**  
Letter _X_ Credit/No Credit

**Instructor Approval Required?** Yes_X No

**Course Classification (e.g., lecture, lab, seminar, discussion):**  
C2

**Title for CMS (not more than 30 characters):**  
Applic. of Computational Chem.

**Cross Listed?**

| Yes_X No |

| If yes, do they meet together and fulfill the same requirement, and what is the other course. Yes; Chem 245. |

**How Many Times Can This Course be Taken for Credit?** 1

**Can the course be taken for Credit more than once during the same term?** Yes_X No
FOR NEW COURSE PROPOSALS OR SUBSTANTIVE CHANGES ONLY:

**Description of the Expected Learning Outcomes:** Describe outcomes using the following format: “Students will be able to: 1), 2), etc.” See the example at http://www.csus.edu/acaf/example.htm

Students will be able to:
1) Understand the basic theory behind standard computational chemistry methods (molecular mechanics, semi-empirical theory, \textit{ab initio} theories, density functional theory, and solvation models) as well as these methods’ strengths and weaknesses.
2) Use these methods to extract chemical information (molecular properties and thermodynamic and kinetic quantities) pertinent to a chemical system.
3) Effectively utilize molecular modeling and computational chemistry software.
4) Learn to design molecular models and optimally match computational methods to problems.
5) Be able to critically assess the application of computational methods in journal articles.

**Attach a list of the required/recommended course readings and activities [Note: it is understood that these are updated and modified as needed by the instructor(s).] This attachment should be forwarded only to your Dean's office, not Academic Affairs.**

**Assessment Strategies:** A description of the assessment strategies (e.g., portfolios, examinations, performances, pre- and post-tests, conferences with students, student papers) which will be used by the instructor to determine the extent to which students have achieved the learning outcomes noted above:

Students will complete in-class activities and homework assignments in order to assess their ability to use the molecular modeling and computational chemistry software, as well as to analyze the chemical information generated by these programs. Quizzes will be given to examine students’ ability to apply their knowledge of computational chemistry to topics in current journal articles. Exams will assess students’ learning of the basic theory underlying the computational chemistry methods. (In the case of Chem 245, there would also be a final paper and oral presentation due in which the student would research a computational method of his/her choice, describing that method’s theory, strengths and weaknesses, and applications.)

**For whom is this course being developed?**

Majors in the Dept _X_  Majors of other Depts ___  Minors in the Dept ___  General Education ___  Other ___

Is this course required in a degree program (major, minor, graduate degree, certificate)? Yes _X_  No ___

If yes, identify program(s):

Does the proposed change or addition cause a significant increase in the use of College or University resources (lab room, computer facilities, faculty, etc.)? Yes ___  No _X_  

If yes, attach a description of resources needed and verify that resources are available.

Indicate which department or programs will be affected by the proposed course (if any). ____________________________

**The Department Chair’s signature below indicates that affected programs have been sent a copy of this proposal form.**

**Accessibility:** Following course approval, and prior to the start of the semester in which the new or revised course will be taught for the first time, an accessibility checklist [available at http://www.csus.edu/accessibility/checklist.html] shall be completed and submitted to the appropriate Dean’s office. An accessible syllabus shall also be made available online, preferably prior to the start of that semester’s open registration period.

**Approvals:** If proposed change, new course or deletion is approved, sign and date below. If not approved, forward without signing to the next reviewing authority, and attach an explanatory memorandum to the original copy.

**Signatures:**

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<th>Department Chair:</th>
<th>Date</th>
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<td>3/11/2011</td>
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<tr>
<th>College Dean or Associate Dean:</th>
<th>Date</th>
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<td>3/21/2011</td>
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**CPSP (for school personnel courses ONLY)**

**Associate Vice President and Dean for Academic Programs**

Distribution: Academic Affairs (original), Department Chair and College Dean. Dean’s office to send original after approval to Academic Affairs, at mail zip 6016. An electronic copy must also be sent.

5/20/2010
Course Readings:

Required:
2) Miscellaneous journal articles featuring applications of computational chemistry to be made available electronically on the course website.

Additional Resources to be put on reserve at the Sacramento State library:

Course Activities:

1) Lectures. Lectures will present and explain the basic theory underlying the computational chemistry methods. Demonstrations of how these methods are implemented in computer software will also be carried out.
2) In-class activities. These activities will be accompanied by detailed procedures and will focus on a single aspect from that day’s lecture. The goal of the activities is to gain immediate hands-on experience in working with the day’s lecture topic.
3) Homework assignments. The homework provides students with a more in-depth and independent opportunity to work with the molecular modeling and computational chemistry software to address questions drawn from various areas of chemistry.
4) Reading journal articles and associated quizzes. The students will gain practice in critically assessing the application of computational methods in journal articles. As computational chemistry becomes more and more widely used in chemical research, the ability to effectively assess such research reports has become increasingly important. The quiz questions will stem directly from the reading and measure the students’ ability to connect classroom learning and journal article content.
5) Mid-term and final exam. The exams will assess students’ learning of the basic theory underlying the computational chemistry methods as presented in lecture and the required reading.
6) For Chem 245 only: A final project in which the student would research a computational method of his/her choice, describing that method’s theory, strengths and weaknesses, and applications. The work would be presented in a brief in-class presentation and as a more thorough written paper.