Minnesota State University, Mankato
Curriculum Proposal

Please type or select the requested information. Print completed forms, add appropriate paper attachments, and route through MSU’s curricular process for recommendations and decisions.

<table>
<thead>
<tr>
<th>College: Science, Engineering and Technology</th>
<th>Proposal #: 351</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department: Chemistry and Geology</td>
<td>Effective Date of Change: Academic Year 06-01</td>
</tr>
<tr>
<td>Program: CIP #</td>
<td>(For Office Use Only)</td>
</tr>
</tbody>
</table>

Type of Change: COURSE PROPOSALS

Title Current: Chemistry for Engineers

Title Proposed: Chemistry for Engineers

24-Char. Abbrev: Chem for Engineers

Course Designator: CHEM 191

Number of Credits: 3

Include a course or program description for the Bulletin (30-40 words maximum for courses, 100 for programs):

This course covers basic chemistry and applications relevant to students interested in the engineering fields.

Pre: Placement into Math 115 or Math 121, high school chemistry or "C" or higher in Chem 104

Rationale or Justification for change:
The General Chemistry I and II courses are designed to provide students with a year long opportunity to learn the basic concepts. Students from some of the engineering majors enroll in the first semester only and thus are not given adequate opportunity to learn applied concepts that are more applicable in their future fields. Developing a course that is specifically designed for engineers will allow these students greater exposure to the concepts and applications that will benefit them.

***For General Education or Cultural Diversity Courses Only***

<table>
<thead>
<tr>
<th>GE Category #</th>
<th>GE Category Name</th>
<th>(Maximum of 3 Categories)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Critical Thinking</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Natural Science</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For Writing Intensive Courses, attach a description of the kind and quantity of writing.

For Upper Division Courses, include a description of the respects in which it is broad and general rather than narrow and specific, and so suitable as GE.

Attach paper copies of the following:

a. Syllabus or course outline.

b. Course's student learning outcomes associated with each GE competency or CD designation.

c. List of strategies to be used to assess students' achievement of each GE competency or CD designation.

***For New Courses***

<table>
<thead>
<tr>
<th>Instructional Type: Lecture</th>
<th>Course will be offered:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Check all that apply:)</td>
<td>X Fall Semester</td>
</tr>
</tbody>
</table>

Course is an elective.

X Course is required for program Engineering programs in EE, ME and CIVE

Pre- or Co-requisites: Placement in Math 115 or Math 121, High School Chem

Other courses are being changed or eliminated. (Explain.)

Course content or title is similar to courses in other departments. (Attach copy of letter of agreement with other program(s) contacted. Indicate the nature of the discussions and/or resolution of differences or potential conflicts.)

Attach paper copies of the following:

a. Syllabus or course outline.

b. Course's student learning outcomes.

c. A list of resources required to offer and support this course.

d. A description of how teaching this course will affect department staffing.

e. If 400/500 level course, an explanation of added expectations of graduate students.

Revised September 2002
## Signature Page

### Department

- **Recommended** (Category/ies: *)
- **Not Recommended** (Category/ies: *)

  **Comments:**

  **Department Chair**

  **Date:** 10-10-02

### College Curriculum Committee

- **Recommended** (Category/ies: *)
- **Not Recommended** (Category/ies: *)

  **Comments:**

  **Committee Chair**

  **Date:** 3/9/07

### College Dean

- **Recommended** (Category/ies: *)
- **Not Recommended** (Category/ies: *)

  **Comments:**

  **Dean**

  **Date:** 3/9/07

### General Education Subcommittee

- **Recommended** (Category/ies: *)
- **Not Recommended** (Category/ies: *)

  **Comments:**

  **General Education Subcommittee Chair**

  **Date:** 9-25-07

### Undergraduate Curriculum and Academic Policy Committee

- **Recommended** (Category/ies: *)
- **Not Recommended** (Category/ies: *)

  **Comments:**

  **UCAP Faculty Chair**

  **Date:** 11/6/07

### Faculty Association Graduate Committee

- **Recommended**
- **Not Recommended**

  **Comments:**

  **Faculty Association Graduate Chair**

  **Date:**

### Graduate Dean

- **Recommended**
- **Not Recommended**

  **Comments:**

  **Graduate Dean**

  **Date:**

### Academic Affairs Council

- **Recommended** (Category/ies: *)
- **Not Recommended** (Category/ies: *)

  **Comments:**

  **Assistant Vice President**

  **Date:** 4/10/07

### Senior Vice President and Vice President for Academic Affairs

- **Approved** (Category/ies: *)
- **Not Approved** (Category/ies: *)

  **Comments:**

  **Sr. Vice President / Vice Pres. Academic Affairs**

  **Date:** 4/10/07

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Revised September 2002
Chemistry for Engineers course outline-

Chem 191 Chemistry for Engineers (3 credits)
Lecture: 3 lectures / week
prerequisites: college algebra, high school chemistry or “C” or higher in Chem 104

course description:
This course covers basic chemistry concepts and applications relevant to students interested in engineering fields.
Pre: college algebra, high school chemistry or “C” or higher in Chem 104
GE-2, 3

rationale for change:
The General Chemistry I and II courses are designed to provide students with a year long opportunity to learn the basic concepts. Students from some of the engineering majors enroll in the first semester only and thus are not given adequate opportunity to learn applied concepts that are more applicable in their future fields. Developing a course that is specifically designed for engineers will allow these students greater exposure to the concepts and applications that will benefit them.

Student Learning Outcomes on attached sheet.


Possible Student Assessment:

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework sets (7 @ 20 pts)</td>
<td>140</td>
</tr>
<tr>
<td>Group Work</td>
<td>110</td>
</tr>
<tr>
<td>Exams (4 @ 75)</td>
<td>300</td>
</tr>
<tr>
<td>Final Exam</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>650</td>
</tr>
</tbody>
</table>

A possible outline of topics for class days:
typical term ~72 class days = ~42 class days for a 3 credit course ~38 lectures after exams

Using the Shultz textbook as an example:
4 lectures Chapter 1: Fundamental Concepts
4 lectures Chapter 2: Foundations
3 lectures Chapter 3: Physical and Chemical Periodicity
3 lectures Chapter 4: Metallic Bonding and Alloys
3 lectures Chapter 5: Chemical Bonding and Modern Electronics
3 lectures Chapter 6: Shape and Intermolecular Interactions
3 lectures Chapter 7: Thermodynamics and the Direction of Change
3 lectures Chapter 8: Equilibrium
3 lectures Chapter 9: Electrochemistry
3 lectures Chapter 10: Coordination Chemistry
3 lectures Chapter 11: Polymers
3 lectures Chapter 12: Kinetics
### Student Learning Outcomes for Chemistry for Engineers; Chem 191

<table>
<thead>
<tr>
<th>Student Learning Outcomes (performance, knowledge, attitudes)</th>
<th>assessment tools used by instructor include:</th>
<th>course specific content/topics</th>
<th>Standard of Mastery/ Criterion of Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Students will demonstrate a basic knowledge of the laws of thermodynamics and apply these to relevant problems.</td>
<td>in-class problems exams homework</td>
<td>Enthalpy entropy, Gibbs free energy</td>
<td></td>
</tr>
<tr>
<td>2. Students will demonstrate knowledge of the principles of kinetics and apply these to relevant problems.</td>
<td>in-class problems exams homework</td>
<td>rate laws temperature dependence</td>
<td></td>
</tr>
<tr>
<td>3. Students will demonstrate an understanding of properties and structure of matter and its phases related to bonding and interparticle forces then apply these concepts to relevant problems.</td>
<td>in-class problems exams homework</td>
<td>basic bonding and shape theory gas theory IPF’s solid structure metallic bonding and alloys nonmetallic bonding</td>
<td></td>
</tr>
<tr>
<td>4. Students will demonstrate knowledge of the basic tenets of quantum mechanics and apply these ideas to atomic structure, periodicity and electronics.</td>
<td>in-class problems exams homework</td>
<td>quantum numbers ionization energy periodic behavior and trends conductivity, semiconductivity, and band gap</td>
<td></td>
</tr>
<tr>
<td>5. Students will demonstrate an understanding of quantitative comparisons in chemistry.</td>
<td>in-class problems exams homework</td>
<td>Stoichiometry balancing rxns equilibria/K’s gas laws</td>
<td></td>
</tr>
<tr>
<td>6. Students will work with and correctly use the terminology of chemists.</td>
<td>in-class problems/discussions exams homework</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Students will demonstrate a basic knowledge of equilibrium in applications.</td>
<td>in-class problems exams homework</td>
<td>equilibria and thermodynamics phase equilibria acid-base K’s and buffers, Ksp, general Keq</td>
<td></td>
</tr>
<tr>
<td>Statement</td>
<td>Method</td>
<td>Concepts</td>
<td></td>
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<tr>
<td>---------------------------------------------------------------------------</td>
<td>---------------------------------</td>
<td>-----------------------------------------------</td>
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</tr>
<tr>
<td>8. Students will demonstrate an understanding of electrochemistry and the</td>
<td>in-class problems exams homework</td>
<td>oxidation states batteries metallurgy</td>
<td></td>
</tr>
<tr>
<td>applications of electrochemical processes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Students will demonstrate an understanding of the basic ideas of</td>
<td>in-class problems exams homework</td>
<td>coordination chemistry bonding magnetism</td>
<td></td>
</tr>
<tr>
<td>coordination chemistry and its applications.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Students will demonstrate a basic understanding of polymer chemistry.</td>
<td>in-class problems exams homework</td>
<td>basic condensation reactions structure vs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>properties of polymers</td>
<td></td>
</tr>
</tbody>
</table>
RE: new chemistry course

Karen,

The ECET faculty have discussed this proposal for a new Chemistry course for our department majors. We as a faculty are supportive of the proposal for a Chemistry course for Electrical and Computer Engineering students and would like to express our appreciation to the Chemistry department for their efforts on behalf of our students.

Bill

-----Original Message-----
From: Chou, Karen C
Sent: Friday, March 09, 2007 7:39 AM
To: Hudson, William B; Johnson, Charles
Subject: FW: new chemistry course
Importance: High

Charlie and Bill,

Based on my communication (see e-mails below) with Dan Cronn-Mills, UCAP Chair, would you please send an e-mail to me stating your department's position on the proposed course and I will include that to the proposal.

I would appreciate if you would send your department's comments to me by Monday so that I can sign-off the proposal. If you need more time, please let me know.

Thanks,
Karen

-----Original Message-----
From: Cronn-Mills, Daniel
Sent: Friday, March 09, 2007 5:41 AM
To: Chou, Karen C
Subject: RE: new chemistry course

Hi Karen,

This is pretty normal stuff for UCAP, so no problem ... UCAP would prefer some form of documentation that the engineering depts support the course. A simple memo (e-mail) from the dept chair(s) to that effect is sufficient.

thanks,
dan

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Daniel Cronn-Mills
Professor
Dept of Speech Communication
Minnesota State University, Mankato

-----Original Message-----
From: Chou, Karen C
Dear Dan,

I have to bother you again! Our curriculum committee just passed a new course proposal from Chemistry Department. The new course was created for engineering program. However, the proposal does not include any document from any of the engineering department in favor or objecting to the course. Basically, there is no written input from the engineering departments. Even if the course is passed, the engineering programs still have the discretion of whether to modify their curriculum to adopt this new chemistry course or not.

With this as the background, does UCAP requires any written comments from ECET and ME & CIVE regarding this course, "Chemistry for Engineers"?

I hope there is no more difficult proposals submitting to us the rest of the semester.

Thanks,
Karen
To meet the student learning outcomes for this category students should be able to:

A. Gather and analyze information of various kinds, employing formal or informal tools to represent information in ways useful for problem solving.

Through in-class problem and homework will be extensively challenged to rigorously gather and analyze information to solve problems. They will practice a variety of strategies to investigate the problems.

Information will be presented in table form and graph form for students to analyze. One example is data related to pressure volume relationships of gases.

B. Weigh evidence for and against hypotheses.

Throughout the course, students will be challenged to see how experimental data support or reject hypotheses explaining the nature of matter. As students calculate answers to questions, they will need to evaluate the answer to see if it makes sense in the physical world. Does a 1.75 carat diamond really have a mass 2.075 kilograms?

C. Recognize, construct and evaluate arguments.

Through class discussion, homework and exams students will defend answers to complex problems. These problems may require students to state assumptions made in the solution. One example is in the working of stoichiometry problems in which one reagent is the limiting reagent. Students must recognize that one reagent will limit the amount of product produced. In another example from an exam, students need to evaluate the reasonableness of their answer. Students need to answer the question: “Does this answer make I calculated make sense?”
D. Apply appropriate critical and evaluative principles to texts, documents or works---one’s own or others’---in oral, visual or written mediums.

Throughout this course, students will work in groups or teams with constant evaluation of their own and others’ work. Again, as students formulate and calculate answers in groups they must address the question: “does this answer we calculated make sense?” “If so how and if not why?”

GENERAL EDUCATION OUTCOMES
CHEM 191

Category 3
Natural Sciences

To meet the student learning outcomes for this category students should be able to:

A. Develop understanding of scientific theories.

The content of the course focuses extensively on theories describing the nature of matter. The students will have multiple opportunities to develop an understanding of these theories through in-class problems, homework and exams.

B. Formulate and test hypotheses in either laboratory, simulation or field experiences.

Students will be challenged to develop hypotheses during in class exercises. The hypotheses will be tested by lecture demonstrations or simulations. One example will be simulation of Dalton’s law of partial pressure.

C. Communicate his/her experimental findings and interpretation both orally and in writing.

Students will defend answers to problems during class and will be asked on exams to interpret data from experimental data.

D. Apply the natural science perspective to society issues.

Lecture topics, in-class problems and homework assignments will have the student relate chemistry to practical issues that impact society. One example included the titration of a sample of base used in the peeling of potatoes. Other examples will include use of semimetals in construction of electronic equipment.