SOUTHERN CONNECTICUT STATE UNIVERSITY
CHE 340 – Environmental Chemistry
Spring Semester, 2012
Monday, Wednesday – 3:25 pm – 4:40 pm

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Office Hours:
Monday and Wednesday: 2:00 – 3:00 pm
Tuesday: 10:00 am – 12:00 noon
Thursday: 11:00 am – 12:00 noon

Course number: CHE 340
Credit Hours: 3
Prerequisite(s): CHE 120-121

Course Title: Environmental Chemistry

COURSE DESCRIPTION:
Chemistry 340, Environmental Chemistry, is the study of natural and anthropogenic substances in the environment. Specifically, the course will cover the source, transport, reactions, effects and fate of chemicals in the atmosphere, hydrosphere and lithosphere. The course will also examine the interaction of these three areas for chemical substances.

COURSE CONTRIBUTION:
CHE 340 is a course that teaches the students the chemistry of the environment regardless of the source of the chemicals. Students will learn that both natural and anthropogenic sources can cause pollution and the impacts from both may be significant.

Students will apply basic equilibrium chemistry concepts to reaction systems that occur in the environment. Students will calculate impacts based on these systems.
LEARNER OUTCOMES & ASSESSMENTS: Link all course outcomes to NCATE, INTASC and CCCT standards

1. Understand the five major nutrient cycles. Students will learn how naturally occurring chemical reactions in the environment recycle elements associated with the major nutrient cycles. (INTASC: 1,4, NSTA: 1, 2, 3, 4, CCCT: 1.3, 1.4)

2. Learn the concentration units for chemicals in the environment. Students will learn how to the state of matter determines the unit of concentration for a chemical and they will learn how to convert among similar concentrations. Homework and exam questions will be given to enforce this concept. (INTASC: 1,4, NSTA: 1, 2, 3, 4, CCCT: 1.3, 1.4)

3. Calculate $\alpha$-values for chemical species in an equilibrium system. Students will understand how shifts in an equilibrium system will affect the relative amounts of each chemical species in the natural environment and learn how to calculate that amount. (INTASC: 1, NSTA: 1, 2, 3, CCCT: 1.3, 1.4, 1.6)

4. Understand the chemical interactions between pollutants and sediment material. Students will be required to identify the type of intermolecular force involved with interactions between pollutant molecules and humic matter. (INTASC: 1, NSTA: 1, 2, 3, 5, CCCT: 1.3, 1.4)

5. Identify the layers of the atmosphere and understand the characteristics of each. Students will be expected to calculate mixing ratios of gases at different altitudes in the atmosphere and be able to calculate and predict basic meteorological phenomenon. (INTASC: 1, 4, NSTA: 1, 2, 3, 4, CCCT: 1.3, 1.4)

6. Give reaction mechanisms for the oxidation of reduced gases in the atmosphere. Students will demonstrate their knowledge by giving complete photochemical reaction mechanisms for conversions of gases in the atmosphere. (INTASC: 1, NSTA: 1, 2, 3, CCCT: 1.3, 1.4)

7. Incorporate catalytic cyclic reaction mechanisms to describe the creation and destruction of ozone in the stratosphere. Students will demonstrate their understanding of this concept by clearly stating applicable reaction mechanisms and understanding their difference with null cycles. (INTASC: 1, NSTA: 1, 2, 3, 4, CCCT: 1.3, 1.4)

8. Understand the operation of a waste water treatment facility. Students will be asked on homework and exam to identify pollutants that are treated in waste water treatment systems and how the disinfecting process works. (INTASC: 1, NSTA: 1, 2, 3, CCCT: 1.3, 1.4)

9. Understand the bioremediation processes as they apply to pollutant molecules in the natural environment. Students will select the reaction mechanism applicable to each class of pollutants for their bioremediation. (INTASC: 1, NSTA: 1, 2, 3, CCCT: 1.3, 1.4)

10. Use the concepts of oxidation number to assess the toxicity of various heavy metals in the environment. Students will be required to determine the oxidation state of a heavy metal in a pollutant and assess the compound’s toxicity. (INTASC: 1, 4, NSTA: 1, 2, 3, CCCT: 1.3, 1.4)
MODES OF LEARNING

The course is strictly a lecture course. The lecture portion of the course relies heavily on problem solving ability and analytical thinking. Homework assignments will be given throughout the semester to enforce specific important concepts. Three hour exams will be given.

<table>
<thead>
<tr>
<th>Expected Student Learning Activity</th>
<th>Weekly Hours for Course</th>
<th>Total Hours for Course (14-Week Semester)*</th>
<th>Term Credits Earned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture Hours (Contact Time)</td>
<td>3</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Reading and Study Time</td>
<td>6</td>
<td>84</td>
<td></td>
</tr>
<tr>
<td>Assignments</td>
<td>3</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td><strong>Total Hours</strong></td>
<td><strong>12</strong></td>
<td><strong>168</strong></td>
<td><strong>3</strong></td>
</tr>
</tbody>
</table>

* Please note that these times are only estimates based on the Department of Education’s definition of a credit hour and do not guarantee a specific grade in the course. Students may find that they require more or less time to succeed in the course.

COURSE OUTLINE

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Topic</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Environmental Chemistry, Introduction pp 225 - 227 Single Variable Diagrams Handout Soil</td>
</tr>
<tr>
<td>2</td>
<td>The Earth’s Atmosphere</td>
</tr>
<tr>
<td>4</td>
<td>Chemistry of the Troposphere</td>
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<tr>
<td><strong>Exam I</strong></td>
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<tr>
<td>5</td>
<td>Chemistry of the Stratosphere</td>
</tr>
<tr>
<td><strong>Spring Break</strong></td>
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<tr>
<td>7</td>
<td>Water Resources</td>
</tr>
<tr>
<td>8</td>
<td>Water Pollution and Water Treatment</td>
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<tr>
<td><strong>Exam II</strong></td>
<td></td>
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<tr>
<td>8</td>
<td>Water Pollution and Water Treatment</td>
</tr>
<tr>
<td>13</td>
<td>Inorganic Metals in the Environment</td>
</tr>
<tr>
<td>14 and 15</td>
<td>Organic Compounds in the Environment</td>
</tr>
<tr>
<td>18</td>
<td>Disposal of Waste</td>
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<tr>
<td><strong>Exam III</strong></td>
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<tr>
<td>16</td>
<td>Toxicology</td>
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<tr>
<td><strong>Final Exam</strong></td>
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<tr>
<td></td>
<td>Cumulative</td>
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</tbody>
</table>
REQUIRED TEXT(S)


COURSE REQUIREMENTS:

There are three hour exams and a cumulative final exam. In addition, there are graded homework assignments.

Attendance: Regular and prompt attendance is expected.

Accommodating Students with Disabilities: If any student has a particular disability-related need in order to participate in this course, such as, special seating, note-taking assistance, use of tape recorders, or modified examination conditions, please let me know as soon as possible so that appropriate accommodations can be made.

Inclement Weather: When inclement weather threatens, call the university’s WeatherChek voice mail message line (203-392-SNOW) to hear the latest official information on possible delayed openings, class cancellations, or the closing of the university.

Some Final Thoughts: Unfortunately, the question of academic honesty occasionally becomes an issue between an instructor and a student. The best way to avoid this is to be sure that no suspicions arise. Cheating on exams or any phase of this course will not be tolerated. The student handbook outlines the various prerogatives of the instructor in cases of academic dishonesty.

EVALUATION CRITERIA

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best 2 out of 3 one-hour examinations</td>
<td>50%</td>
</tr>
<tr>
<td>Graded Homework</td>
<td>25%</td>
</tr>
<tr>
<td>Final Exam (cumulative)</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

The following final grade schedule will be used:

A = 93 - 100%
A- = 90 - 92%
B+ = 87 - 89%
B = 83 - 86%
B- = 80 – 82%
C+ = 77 – 79%
C = 73 – 76%
C- = 70 – 72%
D+ = 67 – 69%
D = 63 – 66%
D- = 60 – 62%

STANDARDS GUIDELINES
INTASC STANDARDS
[Interstate New Teachers’ Assessment & Support Consortium]

S
1. Knowledge of subject matter
2. Knowledge of human development & learning
3. Instruction adapted to meet diverse learners
4. Use of multiple instructional strategies & resources

A
5. Effective learning environment created
6. Effective communication
7. Lesson planning

I
9. Reflection and professional development

L
8. Assessment of student learning to improve teaching

S
10. Partnership with school and community

PROFESSIONAL STANDARDS
National Science Teacher’s Association

1. Content – Structure and interpret the concepts, ideas and relationships in science.
2. Nature of Science – Define the values, beliefs and assumptions inherent to the creation of scientific knowledge within the scientific community.
3. Inquiry – Formulating solvable problems, constructing knowledge from data, exchanging information for seeking solutions, developing relationships from empirical data.
4. Context of Science – Relate science to daily life: technological, personal, social and cultural values.
5. Skills of Teaching – Science teaching actions, strategies and methodologies, interaction with students, effective organization and use of technology.
6. Curriculum – Extended framework of goals, plans, materials and resources for instruction.
7. Social Context – Social and community support network, relationship of science to needs and values of the community, involvement of people in the teaching of science.
8. Assessment – Alignment of goals, instruction and outcomes, evaluation of student learning.
10. Professional Practice – Knowledge and participation in the professional community, ethical behavior, high quality of science instruction, working with new colleagues as they enter the profession.

CCCT
[Connecticut Common Core of Teaching]

DEMONSTRATIONS OF KNOWLEDGE
1.1 understanding of student learning & development
1.2 understanding of need for different learning approaches
1.3 proficiency in reading, writing and mathematics
1.4 understanding of central concepts & skills, tools of inquiry and structures of discipline(s)
1.5 knowledge of how to design and deliver instruction
1.6 recognition of need to vary instructional methods

APPLICATION OF KNOWLEDGE THROUGH
2.1 instructional planning based upon knowledge of subject, students, curriculum & community
2.2 selection and/or creation of learning tasks that make subject meaningful for students
2.3 establishment and maintenance of appropriate behavior standards and creation of positive learning environment
2.4 creation of instructional opportunities supporting students’ academic, social and personal development
2.5 use of verbal, nonverbal and media communication fostering individual and collaborative inquiry
2.6 employment of various instructional strategies in support of critical thinking, problem solving and skills demonstration
2.7 use of various assessment techniques to evaluate student learning & modify instruction

DEMONSTRATION OF PROFESSIONAL RESPONSIBILITY THROUGH:
3.1 professional conduct in accordance with the Code of Professional Responsibilities for Teachers
3.2 shared responsibility for student achievement and well-being
3.3 continuous self-evaluation regarding choices & actions on students and school community
3.4 commitment to professional growth
3.5 leadership in the school community
3.6 demonstrations of a commitment to students and a passion for improving the profession
TENTATIVE COURSE CALENDAR:

See Course Outline above.

BIBLIOGRAPHY

