Texas A&M University

Core Curriculum

Initial Request for a Course Addition to the Fall 2014 Core Curriculum

Foundational Component Area: Life and Physical Sciences

In the box below, describe how this course meets the Foundational Component Area description for Life and Physical Sciences. Courses in this category focus on describing, explaining, and predicting natural phenomena using the scientific method. Courses involve the understanding of interactions among natural phenomena and the implications of scientific principles on the physical world and on human experiences.

The proposed course must contain all elements of the Foundational Component Area. How does the proposed course specifically address the Foundational Component Area definition above?

CHEM106/116 is a lecture/laboratory pair with mandatory co-registration that introduces the importance of molecular science in daily life. The properties, synthesis, and transformation of important molecules in fuels, foods, materials, and pollution are considered in discussion and in experiments, demonstrations, and videos. Examples include: the production of air pollution (industrial vs. photochemical smog), its connection to acid rain and water pollution, and its reduction through automobile catalytic converters; chlorofluorocarbons and their relation to the ozone hole and response of the Montreal Protocol; the rise of carbon dioxide and connection to climate change; acid-base buffers in human blood and swimming pools; nuclear isotopes in energy production and medical imaging; and polymer structure relationship to properties and applications in everyday materials. Risk-benefit analysis is considered in the context of current events. The laboratory component emphasizes the use of the scientific method to reinforce and provide supplemental information related to lecture topics.

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Core Objectives

Describe how the proposed course develops the required core objectives below by indicating how each learning objective will be addressed, what specific strategies will be used for each objective and how student learning of each objective will be evaluated.

The proposed course is required to contain each element of the Core Objective.

Critical Thinking (to include creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information):

The scientific method is the fundamental basis of both lecture and lab. Lectures introduce knowledge derived from historical scientific experiments and how scientific theories have evolved with the addition of new information. Daily quizzes and lecture exams include questions to assess students’ ability for critical thinking and analysis and their capacity for synthesizing and integrating information. The laboratory component of the course includes daily quizzes to encourage students to (1) understand the concepts and calculations from the activities they performed in lab the week before as well as (2) read and prepare for the laboratory activities they will be performing that day. Our labs are primarily guided inquiry modules with one that is open inquiry. The laboratory final culminates in an exam that includes all concepts and calculations learned during the semester.

Communication (to include effective development, interpretation and expression of ideas through written, oral and visual communication):

The course requires that students learn the language of chemistry, which involves a new alphabet (chemical symbols), words (chemical formulas), and sentences (chemical reactions). Both lecture and lab utilize visual communication through the preparation and interpretation of graphs, tables, and figures. Students are required to draw and interpret chemical reactions and structures, an important form of written communication. In the laboratory, one experiment is dedicated to the manipulation and graphical
depiction of scientific data. Lab reports, quizzes and exams require students to use this new language in written form to describe the phenomena they investigated. Our final lab is a student group project where groups of 3-4 work on developing a lesson plan for a class in grades K-8 and present to the class, emphasizing oral communication. In the fall semester, the students in groups of 2 or 3 learn a chemical demonstration, prepare a poster with handouts and orally communicate their demonstration to K-12 students for 3 hours at the annual Chemistry Open House and Science Exploration Gallery as a service learning project.

Empirical and Quantitative Skills (to include the manipulation and analysis of numerical data or observable facts resulting in informed conclusions):

Students are required to manipulate and interpret numerical data in nearly every topic of the course. For example, balancing equations requires simple arithmetic; determining average atomic mass requires algebra; and determining pH requires the use of logarithms. Students practice these skills in on-line homework exercises and demonstrate their mastery in lecture exams. Students practice these same skills in every laboratory, including calculation of atomic weights from isotopes, working with Excel, determining and using Avogadro’s number, converting between concentration units, and solution stoichiometry. Students also become proficient at using laboratory equipment: balances, glassware and pH meters

Teamwork (to include the ability to consider different points of view and to work effectively with others to support a shared purpose or goal):

In the laboratory, teamwork is an integral part since students all work in pairs every week. In addition, as stated earlier, there are more opportunities. The class is divided into groups for (1) participation at the Chemistry Open House, (2) final lab where each group of 4-5 present a lesson plan for a 1st – 4th grade science classroom and (3) during their final exam. For the final, students work alone on the final exam for 70% of their final grade. The exams are collected. The students are then divided into formal groups of 3-4 students and are giving a single exam to complete. This is exactly the same exam as before. They can use all resources to complete the exam. This part is worth 30%. In addition, most instructors use ‘clickers’ during the lecture periods and collaboration in answering clicker questions is actively encouraged; learning is reinforced when students informally instruct other students (and lessons are learned by all when wrong answers are arrived at collaboratively!) On-line homework allows for meaningful, graded homework exercises – and in this process of active learning student collaboration is certainly allowed, so long as a balance of individual and group effort is maintained.

Please be aware that instructors should be prepared to submit samples/examples of student work as part of the future course recertification process.