

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?

CHEM101/111 are a lecture/laboratory pair of courses with a mandatory co-registration requirement. They are the first in a two-semester sequence that introduce chemistry for students who intend to pursue degree programs in science or allied fields. The composition, structures, bonding, basic reactivity, and some of the properties of atoms and molecules are the the focus of the course. These properties are connected to applications in many fields. For example, why chemical structure matters in medicine is illustrated with the example of thalidomide. Application of gas laws is related to automobile airbags. Reaction stoichiometry is explained in relation to the Hindenberg explosion. Basic analytical aspects of the subject are introduced as well. Students achieve their learning objectives by their participation in lectures, lecture demonstrations, videos, individual and team-based problem solving sessions (in class and out), and laboratory experiments. In particular, the laboratory component implements the use of the scientific method to reinforce and provide supplemental information related to lecture topics.

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 scientific experiments and how scientific theories have evolved with the need to accommodate new data that reveal the inadequacies of older theories. Lecture exams include questions to assess students' ability to retain fundamental facts of chemistry, to engage in critical thinking, perform quantitative analysis, and their capacity for synthesizing and integrating information in problem solving. Each lab experiment is preceded by a quiz to encourage students to understand the concepts and activities they will be performing in the upcoming lab and be fully briefed on any safety precautions they will be expected to take. CHEM111 labs include a blend of synthesis/preparative work, instrumental measurements, qualitative observation, and the use of simple chemical apparatus. The laboratory culminates in a final exam that includes all concepts, calculations, and procedures 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 some of the necessary vocabulary of chemistry, which involves an unfamiliar chemical symbols, chemical formulas, and chemical reactions expressed in chemical equations. Both lecture and lab utilize visual communication through the preparation and interpretation of graphs, tables, and figures. Students must draw structures and interpret the results of chemical reactions. Several lab experiments

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require manipulation and graphical depiction of scientific data and communication of how the experiments' objectives have been met in the procedures and apparatus used. The collaborative nature of the laboratory requires effective oral communication. Lab reports, homework, and exams require students to use this new language in written format to describe and solve problems involving the phenomena they've investigated.

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

CHEM101/111 students are required to manipulate and interpret numerical data in terms of chemical theory when covering most of the the courses' topics. After a survey/review of stoichiometry and descriptive chemistry, they move through a succession of more demanding applications of math and physics to chemical problems. A facility with the use of high-school algebra is assumed and demanded in most exercises. A basic cognisance of error propagation and significant figures is taught and practiced. The course strikes a balance between the concrete observational nature of chemistry and the numerical and abstract mathematical tools needed to fully comprehend it more fully. We demand and extend students' knowledge of basic physics (e.g., kinetic and potential energy, basic understanding of electrostatics, thermal characteristics of reactions, and application of the results of quantum theory to atoms and molecules.) The role of intermolecular forces in determining the physical properties of substances are discussed in lectures and gathered in the laboratory and subjected to numerical fitting and comparison with expectations/predictions from theory. All of this forms a basis for deeper investigation of the chemical phenomena in CHEM102/112.

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

Teamwork is an essential part of all laboratory work, since students all work in pairs every week and share all data collected. In the conduct of some experiments, students will work in "pairs of pairs" in the use of shared instrumentation. Students write their own laboratory reports and quickly learn that effective teamwork and communication during the active observational/data-acquisition phase of the experiment is crucial when they must use the data on their own to generate their interpretations and conclusions. Several experiments utilize class data-sharing components. In some cases, experimentally determined values for each group are collected to determine average values. At other times, "pairs of pairs" divide tasks within an experiment and rely on the data obtained by the other group in their analysis of the entire lab. The three-week class project includes in-class analysis of experimental observations and construction of logic charts to explain the results. While the initial drafts of these charts are composed individually, the work is then peer reviewed by lab partners and other classmates before revisions are made and the final version is turned in. While students are evaluated individually, their participation and ability to learn with others is key to their success in the laboratory. In addition, teamwork is assessed by direct observation of the lab instructor and the assignment of appropriate participation points. 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 (OWL[®]) 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.

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