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?

CHEM107/117, a pair of lab and lecture courses with mandatory co-registration, provide an introduction to chemistry for students who intend to pursue a degree program in an Engineering field outside of chemical engineering. The composition, structures, chemical transformations, and properties of molecules and materials form the focus of the course, as well as the implication of the chemical perspective to an engineer’s perspective and needs. Connections between these concepts and real-life applications in health, environmental science, energy resources, and material science are countless. A few examples are included here: isotopic enrichment for military and energy needs; the electromagnetic spectrum and the different uses of it in our lives, like x-rays, cell phones, microwave ovens; importance of molecular structure in medicines using the example of thalidomide; importance of catalysis in automobile catalytic converters; application of equilibrium principles in production of ammonia and its importance to Germany in WWI. 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 relevant 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 show how scientific theories have evolved with the need to accommodate new data that revealed the inadequacies of older theories. Lecture exams include questions to assess students’ ability for critical thinking, quantitative analysis, and their capacity for synthesizing and integrating information in solving problems. The laboratory component of the course includes pre-lab quizzes 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. CHEM117 labs include a blend of synthesis/preparative work, instrumental measurements, qualitative observation, and some assembly of simple instrumentation and 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):
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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 are required to use written communication to draw and interpret chemical reactions and structures. In the laboratory, several experiments are dedicated to the manipulation and graphical depiction of scientific data and in the written communication of how the experiments' objectives have been met in the procedures and apparatus used in each experiment. The collaborative nature of the laboratory requires effective oral communication between partners. Lab reports, homework, and exams require students to use this new language 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):

In consonance with their engineering career path, CHEM107/117 students are required to manipulate and interpret numerical data in terms of chemical theory in every topic of the course. After a quick survey/review of high-school level stoichiometry, 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 congnisance of error propagation and significant figures is taught and practiced. Ideas from and application of calculus occurs on an occasional basis where pedagogically advantageous – largely to prepare these students for what they will face in their later training. A balance is struck between the concrete observational nature of chemistry and the numerical and abstract mathematical tools needed to fully comprehend observations. We demand and extend students’ knowledge of basic physics (e.g., kinetic and potential energy, momentum, behavior of waves, basic understanding of electrostatics, heat, and quantization of energy) in application to atoms and molecules. Both thermodynamic and chemical kinetic data are discussed in lectures and gathered in the laboratory and subjected to numerical fitting and comparison with expectations/predictions from theory.

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. 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 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.