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?

This course is designed to give an intuitive understanding of the Big Bang and Black Holes, without mathematics, and de-mystify it for non-scientists. The primary goal is for students to use critical thinking about the origin and evolution of the universe and communicate their understanding using their own words to a lay audience. They will use deductive and empirical reasoning to do evidence based-decision making.

---

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):

Before lecture students are required to do the reading and ask critical questions before the lecture period. This naturally aids in the synthesis of material. They then bring those questions to class, where the normal lecture period time is done in a manner of Interactive Engagement, including iClicker questions and synthesis of information. Their primary assignments are short, written documents which require them to synthesize information into a succinct summary in lay language and explain their decision making pedagogy.

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

Students communicate a number of ways throughout the course. In particular, they are required to write multiple papers in a way that they must communicate modern scientific information in lay language. They must interpret data through graph during the reading, and there are many times during the lecture time where they must discuss their thoughts with peers during clicker question times.

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

The students must bring in empirical data and observational facts to explain their evidence-based reasoning in their course in the context of established scientific theories such as Quantum Mechanics and
Texas A&M University
Core Curriculum
Initial Request for a Course Addition to the Fall 2014 Core Curriculum

General Relativity.

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

The team work portion of the course activities are designed to mimic how undergraduate, graduate, postdoctoral and faculty interact in a research environment as a team. This is done in two ways: To discuss the issues, and to work together on the production of a scientific document.

Discussion teamwork: To facilitate discussion between students on science issues as is done in a typical research team, pairs of students are given a conceptual question (in class) and they are to discuss and work together to understand the question and determine the correct answer. They are required to discuss verbally as a two or three person team, but (for evaluation purposes: enter their own answer during lecture with a iClicker. Often these discussion involve discussions with the lecturer for clarification and hints. Thus, like in real research teams they probe the ideas to arrive at a common, and correct understanding.

Written teamwork: As much of science is done in written fashion, where much of the learning comes during the iteration process, a central part of the course is in writing. As is often done in science, especially in physics and astronomy, a typical paper is done where multiple authors collaborate on a single document, but with a lead author and collaborating authors. In this course we include writing assignments where each student interacts and collaborates, in written fashion, with multiple reviewers. While this is not done in person (although that option is available as students draft their original paper), each student writes their own paper and submits it to the Calibrated Peer Review (CPR) system (http://people.physics.tamu.edu/toback/109/WritingAssignments/Why_use_CPR.pdf). This system facilitates the process of teaching students how to evaluate documents using example papers and rubrics. After training for each assignment, each student provides written commentary on the work of others, and is typically expected to incorporate written commentary into their own work. In particular, they give and receive feedback from their peers on their writing assignments and use this feedback for revisions to improve their writing communication skills. As in any building up of competent team members, students are evaluated on the quality of their writing, how well the assess the quality of a document, and how well they provide useful feedback to others. As a side benefit, they learn how to incorporate the value of team work by learning to be a better team member to themselves.

In this context, the discussion-in-class activity supports teamwork directly as students verbally discuss different points of view and work effectively with others to support a shared purpose/goal. Similarly, the team-activity of providing written feedback to team members (and incorporating feedback from others) builds better teamwork skills as students development of excellent papers. Indeed, giving and using written feedback as part of a team further gives the opportunity to give and receive different points of view and to learn the difficult skill of effectively incorporating feedback from team members into a document.

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