

Form E-1-A for Boston College Core Curriculum

Department/Program PHYSICS

May 2019

- 1) **Have formal learning outcomes for the department's Core courses been developed? What are they?** (What specific sets of skills and knowledge does the department expect students completing its Core courses to have acquired?)

The Department of Physics Core courses share with the university's Natural Science Core the same desired outcomes, namely that at the completion of a Core course students will have:

- a) expanded their understanding of the principles, body of knowledge, and investigative strategies that comprise physics and its technological applications;
- b) developed a scientific literacy that will promote curiosity, respect for the scientific method, and general awareness of the limitations of scientific conclusions;
- c) recognized the role of scientific discovery, past, present, and future, in interrelated concerns such as human health, societal well-being, and planetary sustainability; and
- d) appreciated the role of physics in defining their relationship with the natural world and their position within the cosmos.

- 2) **Where are these learning outcomes published? Be specific.** (Where are the department's expected learning outcomes for its Core courses accessible: on the web, in the catalog, or in your department handouts?)

The complete list of outcomes is published on the Department of Physics "Undergraduate Program" www.bc.edu/content/bc-web/schools/mcas/departments/physics/undergraduate.html

and various aspects are included on Core course syllabi.

- 3) **Other than GPA, what data/evidence is used to determine whether students have achieved the stated outcomes for the Core requirement?** (What evidence and analytical approaches do you use to assess which of the student learning outcomes have been achieved more or less well?)

The data differ depending on the nature of the Core course with respect to amount of rigor and mathematical detail. Student evaluations are reviewed for all Core courses. In the problem-solving based Core courses that cover classical mechanics (PHYS1500, PHYS2100, and PHYS2200), the department administers "Force Concept Inventory"/Mechanics Baseline test at the beginning and end of the semester to assess student learning over the semester.

- 4) **Who interprets the evidence? What is the process?** (Who in the department is responsible for interpreting the data and making recommendations for curriculum or assignment changes if appropriate? When does this occur?)

All physics faculty members who teach Core courses participate in interpreting the evidence, for example, by administering and analyzing results from the Force Concept Inventory exams. However, it is the responsibility of the Undergraduate Affairs Committee with the department Chairperson to coordinate the process, evaluating and analyzing departmental data. That committee reports to the physics faculty as a whole and receives their input. Based on this, and in cooperation with the

department's Teaching Committee and Chairperson as needed, the UAC will (a) work with instructors to develop specific ways to better meet program goals and address deficiencies and (b) make recommendations to the Chairperson and/or faculty for changes in the curriculum.

- 5) **What were the assessment results and what changes have been made as a result of using this data/evidence?** (What were the major assessment findings? Have there been any recent changes to your curriculum or program? How did the assessment data contribute to those changes?)

Currently the Department of Physics offers five Core courses. Three are traditional problem-solving two-semester sequences: **PHYS1500-1** is algebra-based and for non-science majors, and the other two are calculus-based. Of the calculus-based courses, **PHYS2200-1** is a smaller course for physical science majors (number of students < 60), and **PHYS2100-1** is larger course for Biology majors and students in the Pre-Health Program (two sections typically with total enrollment well over 200 students). The three of them comprise the basic areas of physics at the introductory level, but differ in focus, the level of rigor, and mathematical detail.

Results: The results of the Force Concept Inventory (FCI) and student evaluations are typically reviewed to improve those courses. This past year the FCI was not administered due to changes in the instructors (see also below). Our students typically score well above the national average on the FCI, so the basic structure of these courses has remained unchanged. Student evaluations were very positive for most of the courses, so no changes in structure are being considered. However, student evaluations were poor for PHYS2101 for the 2nd year in a row. The Chairperson is finding an alternate instructor for AY2019-20.

We also have two Core courses that are more qualitative in nature. *The Art of Physics* (**PHYS1400**) is described as a 'somewhat subjective selection of topics meant to serve as an invitation to consider the power and beauty of physics and its place among the liberal arts', and takes an integrated approach to the philosophy, history, and quantitative reasoning of physics. This summer course, taught in Parma, Italy, has been offered for a few years. A new Core course, **PHYS1701** *Inspiration in Imagination* was offered as a *Complex Problems & Enduring Questions* course (with a coupled entry offered through the English Department). This course resulted from faculty interest and departmental policy, as discussed in faculty meetings, to expand our Core offerings if possible.

Results: Student evaluations for PHYS1701 were quite good, and we planned to offer this course once again during AY2019-20. However, the English Department did not give course release to the counterpart instructor, so the PHYS1701 will not be offered this coming year. PHYS1400 was evaluated for the first time during the summer of 2018. Only one of eight students responded however. We note that the single response was from a non-physics major (as determined from comments). S/he gave the course all excellent (5) scores, and commented "this was an intense month of difficult material to absorb and retain but it was also extremely rewarding. The lectures and history of physics align perfectly with the trips and overall location of Italy... I have found myself grow as a student more in this month than I have in a full academic year." This course is being offered again this summer (2019), and we will try to more strongly encourage students to participate in the evaluation process.

- 6) **Date of the most recent program review.** (Your latest comprehensive departmental self-study and external review)

External review: December 2009