

Form E-1-A for Boston College Core Curriculum

Department/Program PHYSICS

May 2020

- 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?)

The Department of Physics will be offering four Core two-course sequences. Three are traditional problem-solving courses: **PHYS1500-1** (3 credits) is algebra-based and for non-science majors, and includes non-science major students in the Pre-Health Program. The other two are calculus-based. **PHYS2200-1** (4 credits) is a course sequence for physical and computer science majors and math majors with a smaller number of students (< 60), and **PHYS2100-1** (4 credits) is larger course sequence for Biology majors and students in the Pre-Health Program (two sections typically with total enrollment over 200 students). This sequence is also offered during the summer. The three of them comprise the basic areas of physics at the introductory level, but differ in focus, the level of rigor (as reflected in credit hours), and mathematical detail.

Results: The results of the Force Concept Inventory (FCI) and student evaluations are typically reviewed to improve those courses. While we administered the FCI, unfortunately campus was evacuated before we could have the answer sheets scanned and the data processed. Our students typically score well above the national average on the FCI, so the basic structure of these courses (standard for courses of this type) has remained unchanged. Course evaluations were mixed (ranging from adequate to excellent). A Visiting Assistant Professor was hired specifically to teach the challenging PHYS2100-1 sequence, and the instructors were changed for both semesters of PHYS1500-1 and for PHYS2201 as well.

In the past we had offered two Core courses that were more qualitative in nature. *The Art of Physics* (**PHYS1400**) took an integrated approach to the philosophy, history, and quantitative reasoning of physics. This summer course was taught in Parma, Italy. In AY2018-19 a new 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 to expand our Core offerings if possible.

Results: Physics agreed to offer PHYS1701 during AY19-20, but the English Department was not willing to offer the other half of this coupled course. PHYS1400 was reasonably well evaluated, but issues regarding the target audience (balance between quantitative vs. qualitative material) need to be addressed. The course is not being offered during the summer of 2020 and we will re-evaluate the course objectives. In order to provide BC students a qualitative general interest core course, we will be once again offering the *Structure of the Universe I&II* (PHYS1100-1) sequence during AY2020-21; in order to facilitate class participation the course is capped at 30 students (the fall course is already at capacity).

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

External review: December 2009