

Form E-1-A for Boston College Core Curriculum

Department/Program PHYSICS

June 2021

- 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:

Our large introductory courses were taught remotely and so the FCI assessment exam was not administered.

Over the past years we have accumulated a great deal of data from 'iClicker' student responses to (the same) conceptual multiple choice questions. We are now evaluating that data and we have a fairly clear picture of the very specific topics/concepts where a large fraction of students typically have problems. Using the skills we developed during our remote teaching phase, we will now record a series of short (5 - 10 minute) supplemental mini-lectures on these topics for students to access outside of class meetings. These will be sufficiently general so they can be use in a variety of introductory level courses.

We typically get many inquiries regarding astronomy/cosmology courses for non-science majors, so in response we offered *Structure of the Universe I&II* (PHYS1100-1) sequence during AY2020-21; in order to facilitate class participation the course was capped at 30 students and both semesters had courses at/near capacity. The reviews were mixed, in part due to the remote mode offering, and

Finally, we introduced the summer course *The Art of Physics* (**PHYS1400**) into our fall 2021 curriculum. The course takes an integrated approach to the philosophy, history, and quantitative reasoning of physics.

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

External review: December 2009