11. **Assessment of student learning in Physics (BA), Physics (BS) and Physics with Teaching Certification**.

Demonstrate how this revision impacts the assessment of student learning for the major.

| **ULOs** | **CWEOs** | **Student Learning Outcome / Objective** (Students will demonstrate the ability to +[Bloom’s action verb]+ [something] | **Courses** in which **students receive feedback** on this learning objective. | **Measure** (Method to gauge achievement of expected results. A measure can relate to multiple outcomes) | **Target** (Overall level for satisfactory performance on a Measure- Outcome/Objective combination.) | **Timeline** |
| --- | --- | --- | --- | --- | --- | --- |
| **2. Breadth and depth of knowledge** Develop knowledge common to the liberal arts and sciences in the fields of arts, humanities, natural sciences, and social sciences. Students will also develop specialized nowledge and disciplinary expertise | **4.1 Breadth and depth of knowledge:** Understanding the foundational content and philosophical assumptions of one’s specialized area of study | Graduates will demonstrate an understanding of the foundational content of physics. | MATH 111, 112, 211, 261, 270, 308, STAT 291, PHYS 211, 212, 251, 328, 402, 494, ENGR 367, 371, COSC 181, CHEM 495 | Major Field Test – ETS Physics Major Field test, taken by all mathematics seniors in the final month of the degree plan | In each 5 year cluster, physics student results will rank in the upper quartile among all institutions participating. | Assessed every 5 years; Assessment measure will begin in Spring/Summer 2013 |
|  | **Updates:**  **4.1 Understanding the foundational content and philosophical assumptions of one’s specialized area of study.** | **(no change)** | **PHYS 180, 211, 212, 251, 328, 391, 402, 421, 425, 494, ENGR 367, 371, CHEM 495** | **Major Field Test – ETS Physics Major Field test, taken by all physics seniors in the final month of the degree plan** | **In any year, a moving average of the median score among all physics students from the last 5 years will exceed the 60th percentile among all institutions participating.** | **Assessed every year** |
| **4.2 Specialized scholarship.** Become proficient in the scholarship of their discipline and demonstrate specialized skills needed to pursue a career and/or graduate school | **4.2 Scholarship:** Engaging in scholarship in one’s specialized area of study | Graduates will engage in scholarship in physics, demonstrating the professional skills of independent problem-solving, self-directed research, and oral and written communication.  (The Department will provide the opportunity for scholarship activities in physics such as conference attendance and interdisciplinary Collaboratory projects and will encourage professional pursuits such as article submission, summer research, and internships) | PHYS 494, CHEM 495 | Once every 5 years, a sample of three randomly selected student final projects (paper, presentation, video recording) in PHYS 494 will be judged by an external physics consultant, according to a rubric developed by the department that includes a 5-pt. scale for each of the four professional skills included in the objective (20 pts total). | For each professional quality (independent problem-solving, self-directed research, oral communication, and written communication) at least two projects will be judged at the 4 or 5-pt. level and no more than one ranking of 1 or 2 pt will be received. | Every 5 years;  Assessment measure will begin in Spring/Summer 2014 |
|  | **Updated:**  **4.2 Engaging in scholarship in one’s specialized area of study.** | **(no change)** | **PHYS 391, 494** | **Every year student final projects (paper, presentation, video recording) in PHYS 494 will be judged by physics faculty, according to a rubric developed by the department that includes a 5-pt. scale for each of the four professional skills included in the objective (20 pts total).**  **Once every 5 years, a sample of three randomly selected student final projects will be judged by an external physics consultant, using the same rubric, to ensure unbiased judging.** | **(no change)** | **Assessed every year** |
|  |  |  |  | **New measure:**  **Count of students pursuing research experience: For each graduating class, we will record who has engaged in either independent research or a summer REU.** | **In each 5 year cluster, in average at least 50% of graduating physics student will have completed a summer REU, or at least 2 credit independent research in physics or closely related field.** | **Assessed every year** |
| **4.3 Specialized skills** Become proficient in the scholarship of their discipline and demonstrate specialized skills needed to pursue a career and/or graduate school | 4.3 Specialized skills and scholarship: Students will become proficient in the scholarship of their discipline and demonstrate specialized skills required for employment | Graduates will demonstrate sufficient skills to use technology to enhance understanding and simplify computation and to present work professionally with technology. | MATH 111, 112, 211, 261, 270, 308, STAT 291, PHYS 211, 212, 251, 328, 402, 494, ENGR 367, 371, COSC 181, CHEM 495 | Samples of student work in courses using different technologies | In each measurement cycle, samples of both basic and advanced use of at least three technological tools will be identified, representing work from at least four different courses. | Assessment measure will begin in Spring/Summer 2013 |
|  | **Updates:**  **4.3 Developing proficiency in one’s specialized area of study sufficient to pursue a career and/or continue education at the graduate level.** | **Graduates will demonstrate advanced lab knowledge and skills.** | **PHYS 180, 391, 494** | **Student lab reports and lab notebooks will be reviewed and graded according to a rubric developed by the department.** | **At least 75% of students will receive a grade of B or higher on these assignments.** | **Assessed every year** |
|  |  | **New objective:**  **Graduates will be well prepared to get into and succeed in graduate school.** | **N/A** | **For each graduating class, we will record who applies for, and get into graduate school.** | **All who apply to graduate school get in to at least one program** | **Assessed every year** |
| **5. Self-Awareness** Gain awareness of identity, character, and vocational calling | 4.4 Intrapersonal Awareness: Students will gain self-awareness of identity, character, and vocational calling | Graduates will gain an awareness of options for employment, voluntary service and/or graduate education in physics or closely related fields. | PHYS 494 | Students will complete assignments in PHYS 494 related to vocational and educational options in physics and physics education. Once every 5 years, the department will randomly select 5 graduates of the PHYS/PHYT major and analyze the quality of these assignments in terms of awareness of the range of vocational options, according to a rubric written by the department. | Among the 3 samples of student work selected, at least 2 will show evidence of at least satisfactory growth in understanding and awareness. | Every 5 years;  Data will begin to be gathered in PHYS 494 in Spring 2013, with the first formative assessment data collected in Spring 2016. |
| **5. Self-Awareness** Gain awareness of identity, character, and vocational calling | **Updates:**  **Gaining an awareness of options for employment, voluntary service, and/or graduate education in one’s specialized area of study.** | **(no change)** | **PHYS 180, 494** | **Students will complete assignments in PHYS 180 and 494 related to vocational and educational options in physics and physics education.** | **At least 75% of students will receive a grade of B or higher on these assignments.** | **Assessed every year** |
|  |  |  |  |  |  |  |
| **3. Faith knowledge & application** Develop informed and mature convictions about Christian faith and practice | 4.5 Faith knowledge & application: Students will develop informed and mature convictions about Christian faith and practice | Graduates will articulate a maturing understanding of how faith connects to mathematics and how the biblical call to vocation relates to potential career options in mathematical sciences. | PHYS 494, CHEM 495 | (Same measure as above row; likely the same assignments) | Among the 3 samples of student work selected, at least 2 will show evidence of at least satisfactory growth in understanding and awareness. | Every 5 years; Data will begin to be gathered in PHYS 494 in Spring 2013, with the first formative assessment data collected in Spring 2016. |
| **3. Faith knowledge & application** Develop informed and mature convictions about Christian faith and practice | **Updates:**  **Articulating how faith connects to one’s specialized area of study and to potential career options in that area of study.** | **Graduates will articulate a maturing understanding of how faith connects to physics and how the biblical call to vocation relates to potential career options in physics and related fields.** | **CHEM 495** | **Students will write a faith integration paper in CHEM 495 related to how faith connects to science** | **Physics students will score 75% or above on established rubric.** | **Assessed every year** |