Introduction

The physics program of the Department of Physics and Astronomy has established an Assessment Committee that has developed a detailed assessment plan over the last two academic years. Completed late in the 2004-2005 academic year, the plan will be fully implemented during the 2005-2006 academic year. We report here on parts of the plan for which data was already collected or could be collected by the department chair over the summer. One addition to the plan was proposed by the chair, accepted by the committee and carried out early in the fall semester of 2005. The committee plan is submitted along with this document.

The physics program serves three distinct populations: undergraduate non-majors, undergraduate majors, and graduate students. Assessment items are mostly different for these three groups and are reported separately.
Physics Undergraduate Non-majors

1. Overall mission for UG non-Majors - The overall mission is to provide courses which enable non-majors to fulfill part of their science requirements.

The specific missions of each course are:

Physics 100, 100L - The mission is to introduce the students to some general physics concepts and give them a sense of how physics concepts were discovered.

Physics 122, 122L - Similar mission as for Phys 100, but there is an additional mission of building the confidence of the pre-service teachers in teaching science.

Physics 151 to 274 - The mission is to provide sufficient training in scientific thinking, laboratory skills, and physics knowledge for the students to further their studies in their own major fields.

2. These SLOs are presented, sometimes implicitly, in course syllabi and instructor presentations at the beginning of each course

3. Each of these course sequences gives students an increasingly difficult series of problems to solve and questions to answer. Lectures are specifically designed to provide students with the information and techniques to solve or answer the problems and questions that are presented to them. Instructors model problem solving by working examples in the classroom and by interacting with students in formal or informal office hours

4. The following methods have been used to evaluate outcomes:

   a. **Survey of student evaluations of courses.** For all lower division courses considered here, the resulting overall ratings of the courses were:

      |               | Enrollment | Responses | Mean Rating |
      |---------------|------------|-----------|-------------|
      | Fall 2004     |            |           |             |
      | LD Labs       | 567        | 502       | 4.04        |
      | LD Lectures   | 814        | 598       | 4.31        |
      | Spring 2005   |            |           |             |
      | LD Labs       | 591        | 416       | 4.30        |
      | LD Lectures   | 725        | 378       | 4.53        |

Ratings utilize a five point scale, with 1 the worst and 5 the best. The course evaluation form contains several questions—we report here only the result on the question that asks for an overall assessment of the course/instructor.
b. Survey of faculty teaching courses outside of the physics program that have physics courses as prerequisite. A telephone survey of instructors was carried out over a five-day period this fall. A list of all faculty who taught physics-prerequisite courses in either the fall or spring semesters in 2004-2005 was constructed. As many as possible were contacted and asked to respond to 10 questions regarding the physics preparation of their students in various topics. The average of all ratings other than “Not Applicable” is reported below. (“Not applicable” was the most common response, since each such course typically requires only a small part of the general physics background.)

<table>
<thead>
<tr>
<th>Faculty Responding</th>
<th>Mean Rating</th>
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<td>20</td>
<td>13</td>
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The mean rating may be translated into a C+ grade for student preparation. This might be compared with the average grade assigned in lower division physics classes, which is approximately a C. Several faculty respondents commented that the fairly low level of student preparation could be attributed to the lack of a work ethic among students—their understanding of the topics doesn’t improve much in the more advanced courses the respondents teach!

5. Teaching evaluation results are returned to the faculty (after grades are submitted) for them to examine and apply to teaching improvement. In some cases the chair, after examining the evaluation results, may initiate informal discussion with the faculty member to point out problems or solutions. In addition, the physics program has implemented a system of graduate student tutoring for undergraduate students in an effort to improve learning in the lower division courses (as well as to improve graduate student preparation for the qualifying examination—see the graduate student section of this report.)

6. Not applicable for non-majors.

7. Not applicable for non-majors.
Physics Undergraduate Majors

1. **Mission Statement:**

Via our program, an undergraduate physics major who graduates with a B or above should have obtained sufficient training in scientific thinking, laboratory skills, and physics subjects to pursue graduate work in physics or other science fields if he/she so desires.

2. These SLOs are presented, sometimes implicitly, in course syllabi and instructor presentations at the beginning of each course.

3. The physics major comprises a series of courses that require increasingly more sophisticated problem solving of the students. In addition, there are required laboratory courses that involve advanced equipment and techniques similar to those that a physicist would typically encounter in his career.

4. The following methods have been used to evaluate outcomes:
   a. **Course evaluations:** Due to limited statistics, upper division and graduate course evaluations are tabulated together (though the data could be separated). The results for a question regarding overall evaluation of the course/instructor in the last academic year are as follows:

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<tr>
<th></th>
<th>Enrollment</th>
<th>Responses</th>
<th>Mean Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2004</td>
<td>UD &amp; G Lect</td>
<td>98</td>
<td>76</td>
</tr>
<tr>
<td>Spring 2005</td>
<td>UD &amp; G Lect</td>
<td>82</td>
<td>65</td>
</tr>
</tbody>
</table>

   b. **Student progress:** In order to evaluate the success or our program in preparing students either for a career or for further education, we attempt to follow graduating seniors to determine their post-baccalaureate activities. In 2004-2005 there were 4 seniors (an unusually small number). Of these, it appears that only two graduated. Of the two graduates, one is a graduate student in Secondary Education and the status of the second is unknown. We are following up to determine the status of the students who did not graduate.

5. The department carries out mandatory advising for undergraduate majors. The advising program has been focused on ensuring that students move forward in proper sequence to meet graduation requirements (an important problem in a course sequence with a chain of linked requirements.) The advising program may have to be expanded to include more career counseling to ensure that the physics program is appropriate for the students who pursue a physics degree. Faculty members are constantly considering evaluation results as well as student outcomes. They frequently update coursework and laboratory experiments to remain up to date with peer institutions in the preparation of physics majors for advance degree work.

6. The department currently offers 5 courses in the major with W general education credit and has approval to offer a new course for senior physics majors intended to carry E and O credit. All upper division physics courses emphasize
problem solving and analysis. Laboratory courses require the student to engage in the type of inquiry that is typical of a career physicist.

7. See 4b.
Physics Graduate Students

1. Mission Statement:

   The mission is to train students to be independent researchers. An independent researcher is characterized as someone who possesses solid understanding of core physics subjects (Mechanics, E&M, Statistical and Thermal Physics, Quantum Mechanics and Relativity), possesses special skill in his/her research area, able to think critically, and able to formulate and solve research problems.

2. Almost all graduate students entering the program are seeking a career in physics research. Incoming students are assigned an interim advisor. It is expected that this advisor will convey the department expectations to the student. The explicit outcome expectation should be added to the department web page.

3. The graduate curriculum contains coursework that trains students in the core subjects expected of all physicists. Beyond the core, training in the methods of various research areas is carried out in a mentoring model, where each student selects a research area and a professor who is willing to work with the student. During a period of two to four years the student works first on projects proposed by the professor and increasingly on his or her own research project, leading to the dissertation.

4. All graduate students in the physics program are considered in our assessments. Most are seeking a PhD degree, though some end their program with the MS.

5. Graduate students are assessed at four points in their career:
   a. At entrance a written diagnostic exam is administered and used to recommend the initial program of course work (possibly to include upper division undergraduate courses in case of deficiencies)
   b. After two years of course work, a written qualifying examination covers the topics of the basic graduate physics courses.
   c. Within a period of 6 months a preliminary oral examination assesses the preparation of the student for research in his chosen specialty and his or her understanding of the proposed dissertation topic.
   d. After the completion of the dissertation an oral defense evaluates the quality of the research carried out by the student in preparing his dissertation.

6. Depending upon the norm for the particular research field, many graduate students travel to national and international conferences to present results of their research. In most disciplines, graduate students are included in publications by the research group in which they work.
7. Major professors informally keep track of the progress of their graduate students after receipt of an advanced degree. Most of our graduates with advanced degrees go on to employment in university settings or national research laboratories. Some MS recipients are studying/employed in education-related fields.

    In 2004-2005 one PhD was awarded by the physics program. The student is now in a postdoctoral position here.

8. In the 2004-2005 year an unusually large number of students failed to pass the written qualifying examination at the level required for the PhD. In response to this, the department has instituted a number of changes, including a program of voluntary tutoring of undergraduate students by graduate students to give the latter group an opportunity to improve their understanding of basic physics. The faculty is also reevaluating their assignment of grades in graduate courses; many of the students who did not advance to the preliminary examination had high graduate grade point averages. The loss of financial support for students whose GPA drops below a B is a major problem standing in the way of more realistic grading in graduate courses.