

State University of New York at Oswego
Department of Physics
Implementation of Writing Requirements in the General Education Program

The Department of Physics plan for meeting the Writing Across the Curriculum component of General Education requires all five courses to be provided by the department. Ten such courses are being offered to meet this requirement. These physics courses themselves are hierarchical in scope (each one building upon knowledge required in a previous course), so the writing requirement progresses from introductory-level lab reports to comprehensive and intensive research papers based upon original work.

A. Goals:

Graduates with a BA or BS in Physics should be able to:

1. Maintain a well-documented laboratory notebook.
2. Generate and assemble the appropriate components of both written and oral reports. These components include:
 - a. Theoretical (and experimental) background of concepts being explored
 - b. Description of previous work
 - c. Appropriate Diagrams, Tables and Graphs
 - d. Simulations and/or Theoretical Derivations and Predictions
 - e. Data Analysis, including propagation of experimental uncertainties
 - f. Discussion of Results in the context of the goal of the experiment
 - g. Bibliography
3. Develop a written or oral report. This task involves:
 - a. Identifying the audience
 - b. Establishing the level of the presentation
 - c. Establishing the depth of the exposition
4. Write an outline of the exposition
5. Write a detailed report. The report will include the following sections;
 - a. Abstract
 - b. Introduction and Theory
 - c. Experimental Method, including description and diagrams of apparatus used
 - d. Presentation of Raw Data
 - e. Data Analysis and Results, including appropriate graphs and tables
 - f. Sample Calculations, including propagation of experimental uncertainties
 - g. Discussion of Results
 - h. Conclusions
 - i. References

B. Objectives:

The BA and BS degree programs will provide the writing skills development experience each year of the four year program. The development of these skills will proceed in three steps, commensurate with the level of course taken.

- *Introductory-Level*

Students begin to develop the necessary skills with their first course in physics, Physics 111/112. Both the course and the laboratory meet the purposes stated above. For example, problem solving required for the homework assignments and the hour exams involve elements of analysis, synthesis, and communication which are all central to expository writing. In the associated laboratory, weekly written reports are required. These reports are critiqued by the instructor and returned; an opportunity exists to resubmit the lab report for re-evaluation.

- *Intermediate-Level*

Students continue to develop expository writing skills in the remaining three years in numerous 300 and 400 level laboratory courses. These courses are listed below. More extensive reports are required in these upper-division laboratories with emphasis on presenting an informed background on the material in students' own words. These reports are also critiqued by the instructor.

- *Advanced-Level*

Students in all programs are required to complete a Senior Research Project (Physics 496). This is a capstone experience where students work with faculty members on an original research project and present their work in the form of a senior thesis. They are required to write a thesis of 15 or more pages. This project requires a review of the scientific literature on the subject as well as a description of procedures used, a detailed analysis of the data, a discussion of results, and a summary of conclusions. Students taking one of the Advanced Laboratory courses (Physics 430, 431 and 432) as an elective must satisfy the same writing requirements.

C. Courses:

The following courses satisfy the expository writing requirement of the General Education program:

- *Introductory-Level*

PHY 111/112 and 111L	College/University Physics I and Lab (4 sh) *
PHY 212/213 and 212L	College/University Physics II and Lab (4 sh) *

In these two semester sequences (where the lab is required), students submit weekly lab reports whose format is outlined in goal #5 above. These reports constitute about 25% of the final grade in Physics 111/212 and 212/213. Each report is evaluated by the instructor based upon both writing and analysis of the experimental results. At the beginning of the semester, a discussion is held in class of expectations for such report, based upon the above goals.

- *Intermediate-Level*

PHY 313L	University Physics III Laboratory (1 sh) *
PHY 314L	Modern Physics Laboratory (1 sh) *
PHY 321L	Electronics Laboratory (1 sh)
PHY 322L	Optics Laboratory (1 sh)
PHY 362	Electric Circuits (laboratory portion equivalent to 1 sh)
PHY 423L	Quantum Physics II Laboratory (1 sh) *
PHY 435	Computational Physics (laboratory portion equivalent to 1 sh)

Each of these courses is an intermediate-level lab associated with a corresponding lecture course (3 sh) or part of an integrated lecture/lab course (4 sh total). Much more thinking, measurement and analysis goes into completing these labs. Consequently, the reports are much longer than those in the Physics 111/112 and 212/213 sequence. More effort must be put into writing about the theoretical background of the concepts being explored, as well as into the discussion of results. In addition, the role of experimental uncertainties must be considered. Skills in maintaining a well-documented lab notebook are also emphasized. Students are required to present their work in both written and oral presentations. Sample papers from the literature provide the students with a written model for the reports. These reports constitute about 75% of the final grade in these labs.

- *Advanced-Level*

PHY 496	Senior Research Project (3 sh) *
---------	----------------------------------

The Senior Research Project provides a required capstone experience for all students in all tracks in physics. Students in this course are involved in original work in the research fields of the department's faculty. The final report is an important part (50%) of the final grade. Students are to meet all the goals as outlined above. In parallel with the development of this report, which summarizes their accomplishments, the students must prepare a "review"

paper on previous work in this area. Such a paper draws heavily upon library research. This review paper is evaluated by the instructor, about the middle of the semester, and becomes part of the final report. Students are also expected to present their work in end-of-the-semester oral presentations within the department and/or at Quest.

- *Other Advanced-Level Courses*

PHY 430	Advanced Laboratory in Low Temperature Physics (3 sh)
PHY 431	Advanced Laboratory in Nuclear Physics (3 sh)
PHY 432	Advanced Laboratory in Optics (3 sh)

The requirement for all majors to take Physics 496 has superseded the previous requirement that students in the BS program take one of the Advanced Laboratory courses. (Previously, students in other tracks could take these courses as electives.) However, these research-oriented courses remain in the department's curriculum as electives and students enrolled in these courses must satisfy the same writing requirements as described for Physics 496.

D. Implementation:

The courses described above are already in place in the Department of Physics and in each course an emphasis is placed upon the various facets of good scientific writing and oral communication. As at least 6 of these courses are required for all physics tracks (indicated with the *), the faculty of the Department of Physics consider Writing Across the Curriculum to be “embedded” in the programs of study for all majors.

Note: the writing requirements for Physics 111/112 and 212/213 have been standardized in recent years so that instructors of all sections of laboratory must require at least two formal reports each semester.