DEPARTMENT OF PHYSICS
CALIFORNIA STATE UNIVERSITY, FRESNO

MISSION STATEMENT
GRADUATE PHYSICS PROGRAM

The primary mission of the Graduate Physics Program at California State University, Fresno, is to provide graduate students with a solid education in physics, which forms the basis for several career options. Our graduates are able to proceed on to Ph.D. studies, work in industry or teach at the secondary or junior college level. This outcome is achieved by offering a broad-based academic program with the opportunity for specialization in theoretical physics, experimental physics or physics pedagogy.

Each graduate student is required to take Major Field Test (MFT) for physics or Graduate Record Examination (GRE) subject in Physics before or during his/her first semester in our graduate program. MFT and GRE subject for physics are both provided by Educational Test Services (ETS). They are designed to measure the basic knowledge and understanding achieved by senior undergraduate in their major field of study. The emphasis of the test is on the students' firm grasp of fundamental principles and their ability to apply an understanding of them in the solution of problems. Most of the test questions can be answered on the basis of a mastery of the first three years of undergraduate physics. They cover classical mechanics, electromagnetism, optics and wave phenomena, thermodynamics and statistical mechanics, quantum mechanics, atomic physics, special relativity, laboratory methods, and specialized topics covering nuclear, particle, condensed matter physics, etc. It is a national test put out by the ETS, which is used by many colleges and universities as an assessment tool for undergraduate learning.

Based on his/her MFT or GRE performance, each graduate student acquires a common background by completing a recommended course sequence, which covers the major areas of classical mechanics, electrodynamics, quantum mechanics and mathematical physics. The core curriculum for graduate students consists of three courses selected from the following: PHYS 203 (Classical Mechanics), 220A (Advanced Electricity and Magnetism), 220B (Advanced Electricity and Magnetism), 222A (Quantum Mechanics I), and 222B (Quantum Mechanics II). Additional courses are offered in statistical mechanics, particle physics, general relativity, and condensed matter.

Practical application of knowledge is required of a professional physicist. Therefore, in addition to course work, each graduate student is required to perform research in one of the three research avenues offered by the Physics Department: experiment, theory or physics education. Regardless of the chosen area, each graduate student learns to survey the literature, formulate and carry out an independent research

project, write up their results and present a summary of their project in a colloquium setting. Students performing experimental work learn to design and set up experiments and to acquire and analyze data. Students doing theoretical research generally learn advanced mathematical or computational techniques in order to extract numerical results. Students serving as Teaching Associates (TA's) in introductory laboratories gain a wealth of practical teaching experience. In addition, research in physics education generally involves some of the following: the development of visual and diagrammatic teaching aids and demonstration equipment; identification of physics learning difficulties; uncovering the role that misconceptions play in hindering physics learning.

SPECIFIC GOALS AND OBJECTIVES

GOAL 1. To provide students with a background in the principal areas of physics.

Objective 1. Successful students will pass courses and demonstrate proficiency in most of the major fundamental areas listed above.

Objective 2. Elective courses provide students with experience in important special topics.

GOAL 2. To provide adequate opportunity for students to apply their knowledge to practical experimental and theoretical problems.

Objective 1. The required culminating experience is to complete either a project (Phys 298) and a competency examination

OR

a thesis (Phys 299). Either alternative provides practical experience.

Objective 2. Provide computational experience using "Mathematica" and "Excel" and other software packages along with numerical techniques.

Objective 3. Students performing experimental research will become familiar with the operation of research instruments as well as with computer interfacing and digital data handling.

GOAL 3. To prepare students to pursue advanced degrees or to assume positions in education or science or industry, and to provide scientific writing experience.

Objective 1. Students will record/describe their research results in writing and will present their results in departmental colloquia.

Objective 2. Students will gain experience using word-processing and graphics software in preparing written reports, transparencies, posters, etc.

Objective 3. Students will acquire the requisite educational/technical background.

GOAL 1. To provide students with a background in the principal areas of physics.

Objective 1. Successful students will pass courses in most of the major fundamental areas listed above.

Outcome Criteria : The graduate physics students will be able to correctly describe and discuss the main concepts of physics at a level of mathematical sophistication beyond the undergraduate level.

Assessment Method : Specific embedded questions on exams for PHYS 203, 220A, 220B, 222A and 222B

Time Frame : According to the course assessment schedule (see end of document).

Who Will Do The Assessment : The course instructor in each of the above listed courses.

Type of Feedback : Every other year the course instructor will summarize and tabulate final course grades that will be reviewed by the assessment committee*. Odd-numbered courses will be evaluated on odd years and even on even years. The committee will compare student performance against the students GRE scores (see Goal 3, Objective 3) and department norms.

How Will The Data be Used to Improve The Program and Revise Curricula : The Physics Department will discuss performance deficiencies. Significant deviation in students performance from department norms or with the GRE will lead to a review of course lecture material, textbooks and laboratory notebook.

* Note : The department Assessment/Curriculum Committee will consist of three faculty members elected to three-year terms on a staggered basis. The election shall occur annually during the first week of school in the fall semester

Objective 2. Elective courses provide students with experience in important special topics.

Outcome Criteria : Students will broaden their physics knowledge beyond the core subjects listed in Objective 1. They will gain an understanding of some specialized areas in physics, and be able to see how the core subjects provide a foundation for these specialized areas.

Assessment Method : Specific embedded exam questions in the elective courses (PHYS 221, 262, 270, 272, 275T)

Time Frame : Each semester in which these courses are offered.

Who Will Do The Assessment : The course instructor in each of the above courses.

Type of Feedback : Every other year the course instructor will summarize and tabulate the final course grades that will be reviewed by the assessment committee. The committee will compare student performance against the GRE and department norms.

How Will The Data Be Used To Improve The Program And Revise Curricula : The Physics Department will discuss performance deficiencies. Significant deviation in student performance from department norms will lead to a review of course lecture material, textbooks and the laboratory notebook.

GOAL 2. To provide adequate opportunity for students to apply their knowledge to practical experimental and theoretical problems.

Objective 1. The required culminating experience is to complete either a project (Phys 298) and a competency examination
OR
a thesis (Phys 299). Either alternative provides practical experience.

Outcome Criteria : Students taking the exam/project option will complete a research project and pass a general competency exam They will submit a written report describing their research project. Students taking the thesis option will carry out a substantial research investigation which will culminate in the writing of a thesis. Generally, students taking this option should submit their work (if appropriate) for publication to some scientific journal.

Assessment Method : Students taking the exam/project option will have their work assessed by their research advisor who will summarize the results and submit the report to the assessment committee. The competency exam will be administered by the exam committee who will summarize and tabulate the scores for the assessment committee. For students taking the thesis option, the thesis will be submitted to the assessment committee along with a summary of the research provided by the research advisor.

Time Frame : For both options, the project report and exam or the thesis must be completed at least 3 months before the date on which the student intends to advance toward candidacy.

Who Will Do The Assessment : For the exam/project option, the research advisor, the exam committee and the assessment committee will evaluate the project report as well as the competency exam scores. For the thesis option, the research advisor and exam committee will assess the level of the thesis.

Type of Feedback : For the exam/project option, the results of the exam will be discussed with the student. If the student fails to pass the exam, they will be required to re-take the exam in order to advance toward candidacy. For both options, the evaluation of the written report or thesis project will be discussed with the student and results of the exam scores will be discussed with the research advisor. Strong points and weak points of the research, research methods and presentation will be discussed.

How Will The Data Be Used To Improve The Program And Revise Curricula : From the exam, any consistent weakness in the graduate students will result in a review of course lecture material, textbook or curriculum of the course(s) in which the students display deficiencies on the exam. For the written report or thesis, any deficiencies will result in a review of the research/thesis project format. Shortcomings in a particular area such as writing of the report, data analysis, computer programming or software use will result in a recommendation for the research advisor to address these particular shortcomings during the course of the research/thesis project.

Objective 2. Provide computational experience using "Mathematica" and "Excel" and other software packages along with programming languages and numerical techniques.

Outcome Criteria : Students will be able to use some mathematical software to analyze data, solve theoretical problems, and display their final results in a compact and understandable format.

Assessment Method : In the advanced mathematical physics course (PHYS 270), students will use symbolic mathematical software to solve some problems. Also, in their research or thesis project, students will use software appropriate to their discipline. For PHYS 270, the assessment will be done by the course instructor through homework projects and/or exam questions. For a research or thesis project (PHYS 298, 299), the research advisor will determine student progress in this area.

Time Frame : According to the assessment schedule (see end of document).

Who Will Do The Assessment : Course instructor, research advisor and assessment committee.

Type of Feedback : For PHYS 270 the course instructor will report the students' progress in this area to the assessment committee. For a research or thesis project, the research advisor will summarize the students' progress in this area for the assessment committee.

How Will The Data Be Used To Improve The Program And Revise Curricula : The assessment committee will analyze the summaries and report any deficiencies in this area to the Physics Department. Significant deviation in student performance from department norms will lead to a review of course lecture material, textbooks and the laboratory notebook.

Objective 3. Students performing experimental research will become familiar with the operation of sophisticated research instruments as well as with computer interfacing and digital data handling.

Outcome Criteria : Students will use various research tools to acquire and analyze data in connection with a research or thesis project (PHYS 298, 299).

Assessment Method : The student will write a research report for the project connected with PHYS 298. For a thesis project, the student will write a thesis describing the research.

Time Frame : The report or thesis should be written within three months after the conclusion of the research or thesis project.

Who Will Do The Assessment : The assessment committee.

Type of Feedback : The assessment committee will meet at the end of the spring semester and review any research reports or thesis.

How Will The Data Be Used To Improve The Program And Revise Curricula : After the assessment committee reviews the research reports and theses, any significant deficiencies in student laboratory techniques, theoretical understanding, writing skills or organizational skills will lead to recommendations to amend the research project format to address the deficiencies.

GOAL 3. To prepare students to pursue advanced degrees or to assume responsible positions in education or science or industry, and to provide experience in scientific presentations.

Objective 1. Students will describe their research results in departmental colloquia.

Outcome Criteria : Students will be able to effectively communicate the results and conclusions of an experimental or theoretical physics investigation via an oral presentation in a departmental colloquium.

Assessment Method : The oral presentation will be evaluated by all available faculty members. The student will be given a critique of their presentation afterward

Time Frame : The oral presentation will be assessed within one week after the end of the talk. The presentation will usually occur in the final semester before the student graduates.

Who Will Do The Assessment : The research advisor, and the faculty members who attend the talk.

Type of Feedback : The assessment committee will write a summary of the strong and weak points of the talk, and discuss this summary with the student.

How Will The Data Be Used To Improve The Program And Revise Curricula : Any significant deficiencies in student oral presentation skills will lead to recommendations to amend the research project format to address the deficiencies.

Objective 2. Students will gain experience using word-processing and graphics software in preparing written reports, transparencies, etc.

Outcome Criteria : Students will be able to effectively incorporate standard word-processing and graphics software in preparing written reports or theses for independent research projects.

Assessment Method : Reports or thesis documents will be reviewed by the assessment committee in conjunction with the research advisor to evaluate the students' use of these standard software packages for the assessment committee. The students will make a portfolio of all the research report from PHYS 290, 298 or 299. This portfolio will be examined by the assessment committee.

Time Frame : At the conclusion of an independent research project or study (PHYS 290, 298 or 299). The portfolio will be examined by the assessment committee during the last semester before the student graduates.

Who Will Do The Assessment :The research advisor and assessment committee.

Type of Feedback : The assessment committee and research advisor will determine the level of proficiency displayed by the students in the use of standard software tools in writing a scientific report.

How Will The Data Be Used To Improve The Program And Revise Curricula : Any deficiency in the use of word-processing and/or graphic software will result in a recommendation to provide additional opportunities for students to acquire these skills.

Objective 3. Students will acquire the requisite educational/technical background.

Outcome Criteria: Students will exhibit a certain degree of knowledge and understanding of the major concepts and methods of physics at the time of advancement. Competence will be measured by a score in at least the 25th percentile on the Physics GRE Test. Given the current tight budget, funding for the students to take the exam will be sought through IRAP or the CSM or some other external source. If the funding is not obtained the GRE test will be deferred to the following year. The questionnaire will be mailed to alumni to solicit their feedback on the adequacy of their physics education.

Assessment Method: Standardized GRE Physics exam, and survey form analysis. MFT is an alternative to the GRE and the passing score for the MFT is 50%.

Time Frame: The Physics GRE test must be taken before the student can advance to candidacy. Usually the test will be taken by the student in the semester prior to their expected graduation date.

Who Will Do The Assessment: ETS will grade, tabulate and compare grades to national norms. Students will submit the GRE test scores to the CSU Fresno, Physics Department. The assessment committee will design, mail and analyze the alumni survey form.

Type of Feedback: The results of the standardized test will be reviewed yearly by the assessment committee. It is expected that the class as a whole will average in the 25th percentile or better. The survey form results will be reviewed after each use.

How Will The Data Be Used To Improve The Program And Revise Curricula: Any deficiencies will be addressed by appropriately revising the curriculum.

COURSE ASSESSMENT SCHEDULE AND EVALUATION SUMMARY

2011-2012	2012-2013	2013-2014	2014-2015
203	262	220B	222A
220A	270	272	222B

Every Year: Evaluate research/thesis projects for physics report writing quality, software usage and computational work. Evaluate scores from the GRE exam. Also evaluate any 275T courses.
Odd Years: 203, 220A, 220B, 272
Even Years: 262, 270, 222A, 222B.
Five-Year Intervals: Send out alumni survey form.

ASSESSMENT PLAN ANNUAL REVIEW AND REVISION

The department chair appoints a small committee to review and if necessary modify the program assessment plan annually. Special attention will be made towards incorporating a mechanism where the results of previous assessments will be used on an annual basis to measure performance and implement any associated improvements. The committee will also assess whether or not the current plans include activities that provide actionable data for this annual review.

No cost above faculty members' time on this committee work is needed. However, some assessment tools that might be incorporated in the plans may have annual fees associate with them. Sources of funding will be sought as appropriate.