

GRADUATE STUDENT REQUIREMENTS

DEPARTMENT OF PHYSICS, NMSU

(Effective starting January 2001, approved by the faculty in November 2000)

These requirements have been developed by the faculty as a means of insuring that students in our graduate program will acquire the skills needed for a successful career in physics. Exceptions to these requirements are handled via petition to the faculty.

A. GENERAL REQUIREMENTS

A1. Diagnostic interview. An oral interview will be given to each entering graduate student by an advisory committee, to assess the student's strengths and weaknesses. The immediate result of this interview will be course recommendations for the first semester.

A2. Student advising. After the interview, the Department Graduate Advisor or another faculty member chosen by the student and approved by the Department Head will serve as the graduate student's advisor. The advisor will meet with the student at least once a semester to develop an individual program of study, assess the student's progress, and recommend changes in the program of study as appropriate. The student should choose a research advisor as soon as possible, preferably no later than the third semester at NMSU. This person becomes the student's new advisor.

After the student passes the qualifying examination (see session **D**), the Department Head will appoint physics faculty members to serve as the student's graduate committee, based on recommendations from the student and the student's advisor, so that the committee includes at least one theorist and one experimentalist. Normally, this committee will then continue for the remainder of the student's graduate study, with appropriate augmentation for examinations. The student may petition to change the membership of this committee at any time.

A3. Computer programming. Each entering student must present evidence of knowledge of computer programming to the diagnostic interview advisory committee or to the Department Graduate Advisor. Otherwise, a programming course will be assigned early in the student's program of study.

A4. Laboratory course. Every student must take and pass a 500-level laboratory course.



B. M.S. DEGREE REQUIREMENTS

These include the university requirements, the general requirements outline in **A**, plus the following:

B1. Credits. All M.S. students must satisfy the following 3 requirements of credit hours:

1a) Obtain a minimum of 21 credits of courses and research numbered 450 or above in the Department of Physics,

1b) If selecting the thesis option, obtain a minimum of 21 credits of formal courses numbered above 450 (exclusions: 500, 599, 600, 700) plus 4-6 credits of *Master's Thesis* (PHYS 599 or GPHY 599), or

If selecting the nonthesis option, obtain a minimum of 27 credits of formal courses numbered above 450 (exclusions: 500, 599, 600, 700), and

1c) Obtain a minimum of 30 total credits. Credits earned by taking courses in the Physics Department as well as other departments at NMSU, by doing research at NMSU, and by graduate credits transferred from other institutions will be counted for the purpose of computing the total credits.

No more than 9 credits at the 450-499 level may be applied toward the above credit requirements. Credits earned at the graduate level at other institutions within the 7-year limit may be counted toward the requirements above, if recommended by the Department and approved by the Dean of the Graduate School.

B2. Specific course requirements. All M.S. students must complete one 500-level laboratory course.

B3. Qualifying examination. All M.S. students must take and pass the qualifying examination at the Master's or Ph.D. level (see session **D**).

B4. Final examination. All M.S. students must pass the final oral examination administered as described in the *Graduate Bulletin*. The examination covers the entire course work and, if selecting the thesis option, the thesis work. The Ph.D. comprehensive examination may substitute for the oral final examination



C. Ph.D. DEGREE REQUIREMENTS

These include the university requirements, the general requirements outline in **A**, plus the following:

C1. Credits. All Ph.D. candidates must satisfy the following 3 requirements of credit hours:

- 1a)** Obtain a minimum of 36 credits of formal courses in the Physics Department numbered above 500 (exclusions: 500, 599, 600, 700),
- 1b)** Earn a minimum of 18 credits of *Doctoral Dissertation* (PHYS 700 or GPHY 700), and
- 1c)** Obtain a minimum of 72 total credits. Credits earned by taking courses in the Physics Department as well as other departments at NMSU, by doing research at NMSU, and by graduate credits transferred from other institutions will be counted for the purpose of computing the total credits. Only courses and research numbered 500 or above will be counted.

Credits earned at the graduate level at other institutions within the 7-year limit may be counted toward the requirements of the 36 Physics-Department credits and 72 total credits, if recommended by the Department and approved by the Dean of the Graduate School. However, no more than 30 transfer credits will ordinarily be approved.

C2. Specific course requirements. All Ph.D. students must satisfy the following requirements:

- 2a)** Pass, transfer or successfully challenge a set of 8 graduate core courses,
- 2b)** Complete one 500-level physics/geophysics laboratory course, and
- 2c)** Complete at least 6 credits of 600-level formal courses. 620 courses can be used to satisfy this requirement.

The 8 graduate core courses for traditional physics students are:

PHYS 511: *Mathematical Methods of Physics I*,
PHYS 551: *Classical Mechanics*,
PHYS 554: *Quantum Mechanics I*,
PHYS 555: *Quantum Mechanics II*,
PHYS 561: *Electromagnetic Theory I*,
PHYS 562: *Electromagnetic Theory II*,
PHYS 576: *Advanced Computational Physics I*, and
PHYS 584: *Statistical Mechanics*.

The 8 graduate core courses for geophysics students are:

PHYS 511: *Mathematical Methods of Physics I*,
PHYS 551: *Classical Mechanics*,
PHYS 561: *Electromagnetic Theory I*,
PHYS 562: *Electromagnetic Theory II*,
PHYS 576: *Advanced Computational Physics I*,
GPHY 530: *Seismology*,
GPHY 540: *Physics of the Earth and Planetary Interiors*, and
GPHY 560: *Physics Geophysical Inverse Theory*.



- C3. Qualifying examination.** All Ph.D. candidates must pass the qualifying examination at the Ph.D. level (see session **D**).
- C4. Comprehensive examination.** All Ph.D. candidates must pass the comprehensive examination at the Ph.D. level (see session **E**).
- C5. Minor requirement.** There is no formal minor requirement. If a student wishes to include a formal minor in the course of study, the requirements of the minor department(s) must be met and the student will be examined in the minor area(s) during the oral part of the comprehensive exam.
- C6. Research.** All Ph.D. candidates are encouraged to become involved in research as early as possible. The department will attempt to help the students to become aware of the research being carried out in the department, and students are invited to begin taking research courses early with faculty chosen by them, and agreed to by the faculty member, without commitment on the part of either the student or the faculty member for future research or dissertation work.
- C7. Publication.** Part of the graduate student's preparation is training to present research results orally at a professional meeting and in writing in the form of a publication. We require each Ph.D. candidate to submit at least one paper based upon his/her research while a graduate student in the department to an appropriate refereed professional journal before the final Ph.D. oral exam.
- C8. Final examination.** After completion of the dissertation, a final oral examination is administered as described in the *Graduate Bulletin*.



D. Qualifying Examination

D1. Purposes of the examination. The main purposes of the qualifying examination are to aid the faculty in i) judging each student's preparedness and ability to perform graduate work, and ii) making timely recommendations to each student concerning a future course of study.

D2. Format and content of the examination. This is a written examination. The problems will generally, but not necessarily, be taken from appropriate textbooks. The textbooks to be used for a particular examination will be announced well in advance. The student will be expected to work 2 senior-level problems each in mechanics, electricity and magnetism, and modern physics or geophysics, plus 1 senior-level problem each in thermodynamics and optics. A choice will be given in each of the 5 categories.

D3. When students must take the examination. Graduate students who enter with master's degrees in physics should take the examination during their first semester. All graduate students must take it no later than their second semester. No student may take the examination more than two times. A student not following these instructions during any academic year will lose department support at the end of that academic year, unless the faculty approves a petition by the student and/or the student's adviser for exception. A missed examination without an excuse approved by the Department Head and the student's advisor counts as a failure.

D4. Scheduling of the examination. The examination will be given in two days early in the Fall and in the Spring semesters. Students may not bring textbooks, class notes, integral tables or other such materials to the exam. They may bring non-programmable calculators. Integral tables will be provided.

D5. Submission and grading of problems. Several faculty members will be asked to submit and grade the problems.

D6. Qualifying examination committee. This committee shall consist of at least three faculty members, with chairman and members named by the Department Head. It shall be responsible for compiling and administering the examination and reviewing the performance of each student and the grading of the examination problems. When appropriate, it will make one of the recommendations mentioned in session **D7** and will make the supporting evidence and data justifying its recommendation available to the whole faculty.

D7. Examination scores and recommendations.

7a) A student achieving 75% or better is automatically admitted to further work toward the doctorate. This does not preclude terminating with a master's degree, if the student so desires and satisfies the appropriate requirements.



7b) If a student achieves less than 75%, the qualifying examination committee will weigh all the data concerning the student and make one of the following recommendations to the faculty:

- i) Admit the student to further work toward the doctorate.
- ii) Limit the program to a master's degree.
- iii) Take the examination again during the next semester. This recommendation is normally made if the student scores below 75% on his/her first attempt.
- iv) Discontinue graduate work. This recommendation is normally made if the student scores below 60% twice.

The faculty as a whole may accept or modify each recommendation of the qualifying examination committee.

7c) A student who scores between 60 and 75% the first time and scores below 75% the second time may elect either the faculty's recommendation or a master's program.

D8. Possible termination of support. If at any time during an academic year or the preceding summer a graduate student receives a recommendation from the department to discontinue graduate study, that student's support will not extend beyond that academic year.

E. Ph.D. Comprehensive Examination

E1 Purposes of the examination. The main purposes of the Ph.D. comprehensive examination are i) to aid the faculty in judging a student's knowledge of core graduate material and ability to reason with and express this knowledge, ii) to require the student to review and become thoroughly familiar with all the core graduate material at one time, iii) to allow the student to organize and present research or plans for research, and iv) to aid the faculty in making timely recommendations to the student concerning a future course of study.

E2 Format and content of the examination. The total examination will consist of a written part and an oral part.

For students in the traditional physics program, the written part will consist of three separate exams of equal length, one on quantum mechanics, one on electromagnetic theory, and one split evenly between classical mechanics and statistical mechanics.

For students in the geophysics program, the written part will consist of three separate exams of equal length, one on seismology, one on electromagnetic theory, and one split evenly between classical mechanics and continuum mechanics.

For a student in an interdisciplinary program, the student's committee will decide on the format and content of the written part.

Each of the three written examinations will require the student to work four problems in a five-hour period. Choices will be given. The problems will be representative of the core graduate material listed in session **C2**. They may be original or from textbooks.



The oral part will be administered by the student's committee. The format of the oral examination will depend on whether the student receives a full pass or conditional pass on the written examination.

With a full pass, the student will be examined largely over physics concepts and ability to solve physics problems. In addition, the student is encouraged to give an oral presentation of prior research and/or a thesis plan in a half-hour period to support his/her admission as a Ph.D. candidate.

With a conditional pass, the student must present additional evidence of qualification for a Ph.D. candidate. This evidence may be in the form of prior research and/or a well-developed research plan. The student must submit written material to the committee supporting this evidence. The examination will be over this research work as well as over physics concepts and ability to solve physics problems.

E3. When students must take the examination. Only students who have passed the Qualifying examination at the doctoral level are eligible to take the Comprehensive Exam. Each student who wishes to pursue the Ph.D. degree must take the written part the first time it is offered after the student has completed the relevant graduate core material. The written part may be taken earlier than this if the student so desires and the advisor agrees. Normally a full-time (≥ 9 credits/semester) graduate student entering with a bachelor's degree in physics should take the written part for the first time during the fifth or sixth semester of studies or earlier, as recommended by the student's advisor and/or by the physics members of the student's committee. A full-time student entering with a master's degree in physics should normally take it during the third semester, or earlier. Normally, no student may take the written part more than two times.

The oral examination must be scheduled in the same semester that the student passes the written examination. A student who receives a conditional pass in the written part on his/her first attempt and does not take the oral examination in the same semester must re-take the written examination in the following semester. The student, however, may petition the faculty for postponing the oral examination to the following semester if he/she forfeits his/her additional chance of taking the written examination.

E4. Scheduling of the examination. The three written examinations will be given on three days in the early Fall and the early Spring semesters, with at least one day between each. The core subject matter areas to be covered on each day will be announced approximately a week in advance. Students may bring non-programmable calculators to the exam, but no textbooks, class notes, or integral tables. Integral tables will be provided. The oral part normally lasts two hours, but may be shortened or lengthened at the discretion of the student's committee. The oral part is scheduled on an individual basis.

E5. Submission and grading of problems. The faculty will be asked to submit problems for the written examination with their solutions to the Comprehensive examination Committee, in sufficient number to ensure adequate coverage and choice within each subdiscipline. Each problem used will be graded by the submitting faculty member.



E6. Comprehensive examination committee. This committee for the written examination will consist of at least three physics faculty members, with the chair and other members named by the Department Head. It is responsible for the following: a) producing balanced workable written examinations consisting of problems designed to achieve purposes i) and iii) in part I) above, b) administering the written part, c) reviewing the performance of each student and the grading of the examination problems, and, if appropriate, consulting with the graders, d) reporting the results (scores) on the written part to the student's committee and to the faculty, with the previous scores, if any, and, when appropriate, supplying the student's committee with copies of the written exams and with one copy (the original) of the student's graded work on these exams, and e) providing to the faculty and/or the student's committee an appraisal of the difficulty of the written exams compared to several recent ones.

E7. Examination scores and recommendations:

7a) Following the written part of the comprehensive examination, the comprehensive examination committee will make one of the following recommendations to the faculty:

- i) The student should be given a full pass of the written part of the comprehensive examination and should take the oral part. This recommendation is normally made if the grade is 70% or greater.
- ii) The student should be given a conditional pass of the written part. This recommendation is normally made if the student scores between 50% and 70%.
- iii) The student should take the written examination again. This recommendation is normally made if the student did not score at least 50% on his/her first attempt.
- iv) The student should discontinue studies without an oral exam. This recommendation is normally made if the student did not score at least 50% on his/her second attempt.

The faculty as a whole may accept or modify each recommendation of the comprehensive examination committee.

7b) The student who receives a conditional pass of the written part on his/her first attempt should normally plan to re-take the written examination the next time it is offered. However, the student may elect to take the oral examination if he/she feels that he/she has evidence of strong research and his/her committee agrees.

7c) The student's oral examination committee may recommend that the student pass, fail, or adjourn the examination. In making its decision the committee will consider all of the factors presented, including grades, written examination scores, research, presentations, written papers, opinions of faculty members, and any other relevant factors. Students will be given two chances to pass the oral exam.

E8. Possible termination of support. If it is recommended by the faculty that the student discontinue graduate studies or the student fails the oral comprehensive examination, graduate assistant support will be terminated no later than the end of that academic year. Teaching assistantship will normally not be extended beyond the 6th (4th) semester for the student who came with a bachelor (master) degree unless the student passes both the written and oral parts of the Comprehensive Examination.

