Qualifying Exam Policy

COMPETENCE AND REMEDIATION:

All M.S. and Ph.D students are required to demonstrate competence in fundamental physics at the advanced-undergraduate level. Competence is shown by passing the Qualifying Exam; see below. Subjects not passed on the Qualifying Exam can be addressed by taking appropriate advanced undergraduate courses; see section on Remediation.

QUALIFYING EXAMINATION:

The Qualifying Exam assesses a student's competence in fundamental physics. The exam is used to identify areas of weakness the student should address to be successful in the graduate program and beyond. The Qualifying Exam provides a formative experience for solidifying a student's command of fundamental physics.

The Qualifying Exam is at the upper-division undergraduate level. The exam tests four subjects: 1) classical mechanics, 2) quantum mechanics, 3) electricity and magnetism, and, 4) statistical/thermal physics. Each subject must be passed for M.S. and Ph.D students.

The Qualifying Exam is in two parts:

- Part A: classical mechanics and quantum mechanics, given in August.
- Part B: electricity and magnetism, and statistical/thermal physics, given in January.

The timing of the Qualifying Exam coincides with the availability of advanced undergraduate courses that can be applied toward remediation; see below.

GRADING: 3 problems are given in each subject area, of which 2 must be passed.

TIMELINE: A student will have two opportunities to take each part of the Qualifying Exam before Spring semester of the student's second year.

STUDY RECOMMENDATIONS: Students should review classical mechanics and elementary quantum mechanics before arriving at MSU to prepare for Part A of the Qualifying Exam.

Subsequently, until a student passes all subject areas of the Qualifying Exam, or has received remediation, the student will be required to take the Qualifier Study Seminar; see below.

More information about the Qualifying Exam, including specific topics and previous exams, can be found at physics.montana.edu/grad/qualifyingexam.html

REMEDIATION:

Subject areas not passed on the Qualifying Examination can be addressed by taking the appropriate advanced undergraduate course and obtaining a grade of B or higher. The acceptable courses for remediation are:

- PHSX 320 (classical mechanics), offered every Fall.
- PHSX 461 (quantum mechanics I), offered every Fall.
- PHSX 423 (electricity and magnetism I), offered every Spring.
- PHSX 446 (thermodynamics & statistical mechanics), offered every Spring.

These courses can be taken multiple times if necessary, **but all remediation must be completed by the end of the student's second year**. Courses taken before arrival at MSU, and MSU graduate courses, do not count toward remediation.

RECOMMENDATIONS:

Competence can be shown by passing all subjects on the Qualifying Exam. However, in some cases, it could be preferable for the student to proceed directly to remediation in some Qualifying Exam subject areas if the student lacks adequate undergraduate preparation. For example, if the student did not take a class in thermodynamics and thermal physics at the advanced-undergraduate level before coming to MSU, that student might want to take PHSX 446.

Generally, a student should pass each subject area of the Qualifying Exam, or receive remediation in that area, before attempting the corresponding graduate course. Students should work closely with their advisors to ascertain the best path.

MINIMUM COURSE OF STUDY FOR THE FIRST YEAR:

1. **2 courses/semester** of core graduate and/or advanced undergraduate courses.
2. **Research**. Students are encouraged to make steps toward initiating research upon arrival at MSU. How research is initiated is at the discretion of a student's advisor, and could include, e.g., attending group meetings, doing background reading, presenting in journal clubs, setting up lab equipment, a small project, and analyzing data.
3. **Qualifier Study Seminar** for students who have not passed all qual subjects.
4. **Teaching seminar** in Fall of Year 1 and **Research seminar** in Spring of Year 1.

SECOND-YEAR REVIEW:

In Spring of Year 2, the student's committee will convene to assess progress toward degree. The committee will consider: 1) course grades, 2) performance on the Qualifying Exam, and, 3) research. By this time, it is expected that the student will have:

- maintained a GPA of at least 3.0 in coursework with passing grades (B-) in any core graduate courses that have been taken.
- passed all Qualifying Exam subject areas (via the exam or through remediation). If the student has not passed all Qualifying Exam subject areas, **remediation in those areas becomes mandatory**.
- made a satisfactory start in research.

The committee makes recommendations and can impose requirements for the student to proceed in the program. In following annual reviews, the committee will determine if the student has fulfilled requirements put in place in the Second-year Review. A student who is not making satisfactory progress toward degree (as determined in the Second-year and subsequent reviews) could be suspended from the program.

EXCEPTIONS:

Exceptions to the timelines for the Qualifier Exam and Second-year Review might be permitted upon petition by the student to their graduate committee.

Transition

- This policy is effective immediately.
- Current first-year students can take both Qual Part A and Qual Part B 2 more times, having up to 4 attempts in each subject. Advanced undergraduate courses for remediation can be taken anytime. Mandatory remediation is imposed in Spring, Year 3 (rather than Year 2), if necessary.
- Current second-year students who have not passed all qual subjects can start mandatory remediation now if the student's committee determines that progress is otherwise satisfactory.