SPECIAL REPORT

OF THE

GRADUATE COUNCIL

concerning

REVISION TO A DEGREE PROGRAM:

PHYSICS (MS)

(#4898)

Presented at the
780th Regular Meeting of the Faculty Senate
October 18, 2018

COUNCIL MEMBERSHIP

GRADUATE COUNCIL


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The Graduate Council recommends approval of this proposal.

Briefly describe the Proposal

This proposal from the Physics Department is to revise the Physics MS requirements to have an MS degree with no thesis requirement. The goal is to attract a growing pool of students, both US-based and international, interested in an MS degree for a variety of reasons. Based on our research into similar programs at other US institutions (Brown University and Stony Brook University, for example), the primary motivations for entering a Physics MS program are: (a) As a "springboard" to a PhD, whereby the student demonstrates their ability to perform well in graduate-level physics courses, enhancing their chances of being then accepted into a PhD program; (b) As a means to develop highly marketable skills and experience that prepares them for a career in the private sector or enhances their chances of being hired into the very competitive tech sector.
Please describe the existing program requirements, listing all required courses and available electives, as well as any additional requirements, and continuation or admissions policies.

1. Minimum of 30 graduate credits taken (course number 500 or higher);
2. At least 15 credits shall be at 600-level or higher Physics courses;
3. At least 21 of the credits must be in Physics;
4. At least half of the total credits must be for a letter grade, and the GPA must be at least 3.0;
5. Independent Study credits are allowed;
6. Must have five Physics courses with an A or B;
7. A maximum of 6 credits of graduate-level coursework taken at another institution can be transferred to the UMass M.S. program.
8. Must have one course in the Quantum Mechanics sequence, or equivalent.

Please describe the requirements that you are proposing, listing course requirements, elective options, as well as any additional requirements, and continuation or admissions policies.

1. Minimum of 30 graduate credits taken (course number 500 or higher);
2. At least 12 credits shall be at 600-level or higher Physics courses;
3. At least 21 of the credits must be in Physics;
4. At least 21 of the total credits must be for a letter grade, and the GPA must be at least 3.0; The Physics Graduate Program Director must provide approval before a class may be taken as pass/fail.
5. Independent Study credits are allowed, up to a maximum of 6 credits. All Independent Study credits must be approved by the Physics Graduate Program Director, who will ask that a comprehensive plan be drawn to ensure that the credits earned reflect a sufficiently high level of study or training and that the means of evaluating performance are appropriate;
6. A maximum of 6 credits of graduate-level coursework taken at another institution can be transferred to the UMass M.S. program, subject to approval by the Physics Graduate Program Director. Courses taken as pass/fail cannot be transferred.

Please provide the rationale for these revisions.

The MS degree in the Physics Department has exclusively been used as a terminal degree for PhD students leaving the program. These students almost always had some research experience, which was part of the MS degree requirements in addition to course work. There is now strong support in the department to admit students from outside UMass into a MS program. These students will be coming here primarily to take courses, and not specifically to do research. For that reason it makes sense to redesign the MS program requirements so that it's a better fit to the needs of these students. The proposal is to make the MS degree be a course-based program. Although the thesis option is being dropped, the intensity of the course work and the construction of each student’s program to fit a specific goal for choosing to pursue the MS means that the student will typically take at least three semesters to complete all requirements. Examples of coursework are provided below, consistent with the motivations students have for entering a Physics MS program, as provided in our proposal description above.
Focus: preparing for a Ph.D. program in condensed matter physics

Fall Semester 1

- Physics 601 (Classical Mechanics: 3 cr);
- Physics 605 (Mathematical Methods in Physics: 4 cr).

Spring Semester 2

- Physics 606 (Classical Electrodynamics: 4 cr);
- Physics 614 (Quantum Mechanics I: 3 cr).

Fall Semester 3

- Physics 602 (Statistical Mechanics: 3 cr);
- Physics 615 (Quantum Mechanics II: 3 cr);
- Physics 850 (Soft Condensed Matter Physics: 3 cr).

Spring Semester 4

- Physics 558 (Solid State Physics: 3 cr);
- Physics 531 (Electronics for Scientists I: 4 cr).

Total credits: 30

Focus: preparing for a Ph.D. program in nuclear/particle physics

Fall Semester 1

- Physics 601 (Classical Mechanics: 3 cr);
- Physics 605 (Mathematical Methods in Physics: 4 cr).

Spring Semester 2

- Physics 606 (Classical Electrodynamics: 4 cr);
- Physics 614 (Quantum Mechanics I: 3 cr).

Fall Semester 3

- Physics 602 (Statistical Mechanics: 3 cr);
- Physics 615 (Quantum Mechanics II: 3 cr);
- Physics 714 (Introduction to High Energy Physics: 3 cr).

Spring Semester 4

- Physics 811 (Quantum Field Theory I: 3 cr);
- Physics 852 (Special Topics in High Energy Physics: 3 cr);
- Physics 531 (Electronics for Scientists I: 4 cr).
Total credits: 33

Focus: Instrumentation, for students preparing for career in industry

Fall Semester 1

- Physics 531 (Electronics for Scientists I: 4 cr);
- Physics 605 (Mathematical Methods in Physics: 4 cr).

Spring Semester 2

- Physics 553 (Optics: 4 cr);
- Physics 558 (Solid State Physics: 3 cr).

Fall Semester 3

- Physics 602 (Statistical Mechanics: 3 cr);
- Physics 796 (Independent Study in a Lab: 4 cr).

Spring Semester 4

- Physics 606 (Classical Electrodynamics: 4 cr).
- Physics 896 (Independent Study in a Lab: 4 cr).

Total credits: 30

Academic Requirements Review

The MS degree requirements satisfy Grad School requirements.

Resources

If this proposal requires no additional resources, say so and briefly explain why. If this proposal requires additional resources, explain how they will be paid for. For proposals involving instruction, indicate how many new enrollments are expected and whether the courses have room to accommodate them.

The proposal doesn't require any additional resources. The reason for this is that the courses required for the MS are already taught for our BS students (these are the advanced 500 level courses) and for the graduate students (these are the 600 level courses). We anticipate accepting no more than 10 MS students, but more typically 6-8 students, to complement our entering class of PhD students that constitutes typically 15-20 students. This will not have negative consequences for our available resources.

MOTION: That the Faculty Senate approve a Revision to a Degree Program: Physics (MS), as presented in Sen. Doc. No. 19-011.