

APPLIED PHYSICS

GRADUATE STUDENT PROCEDURES

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Welcome to the Applied Physics Program!

1. GETTING STARTED

Student Picture Identification Card (M-card): Please go to the Student Activities Building (SAB), Room 100 for your University of Michigan student picture identification card (M-card). Your driver's license or passport, along with Rackham's letter or Applied Physics' letter of admission will make this process easier.

Your Picture: A picture will be taken of you upon entering the program to be added to the Applied Physics student display and website.

Computer Access: The University of Michigan will issue your unique name for e-mail, personnel, payroll, and academic records uses. Please inform the Applied Physics administrator of your unique name so that it will be added to the Applied.Physics@umich.edu e-mail group.

You will need to keep your personal information (address, phone, etc.) up-to-date in Wolverine Access.

Applied Physics students are allowed access to the CAEN computer accounts in the College of Engineering, if needed.

Remember to download your files since the system is purged at the end of every term.

Applied Physics students will also want to become acquainted with the computer lab at 2047C Randall Laboratory for personal use. You will also have access to a computer in your student office.

Direct Deposit: For direct deposit of fellowships, stipends and other student payments, direct deposit is available. See the program administrator in the Applied Physics office to fill out a form. Please note that there is a two week – to one month delay from the date you start your checking/saving account. Please keep your university records updated with your address so that the University can send your payroll deposit stub to the correct address. You may update your records in Wolverine Access.

Fellowships: Fellowships are paid three times a year: at the beginning of fall, winter and spring terms but will be paid in monthly payments beginning September 2009.

Taxes: For answers to current tax legislation, international treaty exemptions or the University deduction policy, contact the Student Financial Operations Office (2226 SAB, 764-7447) or the International Center (603 East Madison 764-9310).

Office Assignment and Keys: The Program Assistant will direct you to your student office and will have key forms issued for your office and building keys. Please take the key request forms to the Key Office at 525 Church Street. A deposit of \$10 for each key is required in cash. It is a good idea to have your receipts kept in your student file in the Applied Physics office to make your deposit reimbursement a painless process after you have moved to another office or completed your Ph.D..

Book Purchases and Copier/Fax Access: We recommend that you purchase your textbooks after the first class session to be certain that the books have not been changed by the instructor. There is a copier and fax available to you in the Applied Physics office at 267 West Hall.

Graduate Student Instructor (GSI) and Research Assistant (RA) Appointments: The Applied Physics Program does not have GSI positions. If you are awarded a GSI, it is through another university department. The employment relationship of a GSI is governed by and subject to the provisions of a collective bargaining agreement negotiated by the Graduate Employees Organization (GEO) and the University. Membership in the Union, or the payment of a service fee, is a condition of employment. Union dues and service fees are 1.15% of total employee salary.

Research Assistantship (RA) appointments are through the program or the department of your research advisor. The RA is not included in the GEO collective bargaining agreement. You must register for at least six hours per semester, but nine credit hours are recommended. Payments are the end of each month.

Credit Hour Requirements

As a pre-candidate, you must register for 9 credit hours per term. Once you have achieved candidacy, you are required to register for 8 credit hours per term. It takes 68 credit hours to complete a Ph.D. and 50 credit hours if you have entered the program with a relevant masters degree.

Health Coverage: GradCare: On-line registration is necessary every term or each time the account you are being paid from- changes. The Benefits' Offices is located at 3003 S. Sate St., Low Rise G250.

Applied Physics Initial Requirement Summary: The Applied Physics Program requires satisfactory progress toward the Ph.D. degree. As a minimum, this includes maintaining at least B grades in Applied Physics 500-600 level courses, passing the Qualifying Examination, and making steady progress with your research.

We encourage our students to become associated with a research group during this first year, either through the supervised research course or by some other mutual arrangement. Early involvement in research is an integral part of the Applied Physics program and you will find many opportunities are provided by the multidisciplinary spread of our research activities. Since an early involvement in research is an important step toward the Ph.D., we encourage students to remain here during the summer months and receive financial support from research projects.

Please note that all Applied Physics students are required to take a Qualifying Examination before or during their second year of study. The oral examination consists of a brief presentation of your supervised research followed by questions on standard undergraduate level physics.

Core Course Equivalence: Often students entering the Applied Physics Program will have already taken one or more courses which are equivalent to ones offered here. If you believe this might apply to your situation, please see the director. For requests for courses to be considered for equivalency to satisfy Applied Physics Ph.D. core requirements, please provide the Director with the following information for review: (1) course description and/or outline, (2) textbook title and handouts, (3) course notes taken by the student, and (4) homework assignments and the student's solutions (graded). (see form on APPPHYS Procedures Page 4.), (5) official transcript of classes.

Tutoring: Please talk with the director or the program administrator to arrange for tutoring or to see how you can become a tutor.

Dropping Classes: The director must be consulted to drop classes.

2. APPLIED PHYSICS CURRICULUM

FIRST YEAR STUDENTS

Electricity & Magnetism I (Phys 505)⁺
or Electromagnetic Theory I (AP 530)⁺

Electricity & Magnetism II (Phys 506)⁺

Applied Quantum Mechanics I (AP 540)⁺
or Quantum Mechanics I (Phys 511)

Quantum Theory of Light (AP 609/EECS 638)⁺
or Quantum Mech. II (Phys 512)

Statistical Physics (Phys 510)

Supervised Research (AP 715)

Elective related to your research

Seminar Attendance (AP 514) *One Credit*

SECOND YEAR STUDENTS

Computational/Math Methods Elective ⁺⁺

Elective Course*

Condensed Matter (Phys 520)⁺ or equivalent
or (EECS 520)

Elective Course*

Elective Course*

Elective Course*

Seminar Participation (AP 514) *two credits*

⁺ Options to be discussed with Program Director

^{*} At least two electives must be at the 600 level

⁺⁺ One of the following must be elected:

Microcomputers in Experimental Research (AP 518)
or Methods of Applied Math I (M 556)
or Numerical Methods for Scientific Computing I (M 571)
or other approved computer/math methods options

THIRD YEAR STUDENTS

Seminar Participation (AP 514) *two credits*
Plus any remaining elective courses

3. **GRADES** (taken from the Rackham website)

To maintain satisfactory academic standing, graduate students must make satisfactory progress toward their degrees and have a minimum Rackham cumulative grade point average (GPA) of B (5.00 on a 9 point scale). Programs and departments may have separate requirements for grades necessary to maintain satisfactory academic standing. Students who fall below this average are placed on academic probation. Courses in which grades of D or E are earned cannot be used to fulfill degree requirements.

Instructors enter grades on the student's permanent academic record. Students may elect courses without letter grades, either as a visit (audit) or for Satisfactory/Unsatisfactory (S/U) grading. A visit (audit) does not count for credit, but a grade of S does.

The academic transcript is part of a student's academic record. Other University offices collect and maintain necessary information (records) about students. These records and the transcript together constitute the student's permanent academic record. For more information about the permanent academic record, see "[Student Rights and Records](#)."

The permanent academic record is the history of a student's academic progress in the Graduate School and cannot be altered except in conformance with policies governing dropping, adding, and modifying courses, and the achievement of milestones (e.g., receipt of a degree, advancement to candidacy, etc.). This record may not be altered because of dissatisfaction with a particular instance of academic performance.

Coursework is graded with a letter system (A, B, C, D, or E), except for special courses noted below. An instructor may add "+" or "-" to grades. Letter grades are converted into numbers, or points, as follows:

A+ = 9	B+ = 6	C+ = 3	D = 0
A = 8	B = 5	C = 2	E = 0
A- = 7	B- = 4	C- = 1	

These numbers are used to calculate Michigan Honor Points (MHP) and the Grade Point Average (GPA).

Michigan Honor Points (MHP) are calculated by multiplying the number of credit hours for which the course was elected by the number of points earned on the grading scale. For example, a grade of B+ for a 3 credit hour course produces 3 (credit hours) x 6 (points for a grade of B+), or 18 honor points. The grade point average (GPA) is calculated by dividing Michigan Honor Points earned for a term or more by the number of semester hours (or credit hours) for the courses. A total of 91 MHP for 13 course credit hours produces a GPA of 7.00.

Other transcript notations include:

Visits (VI)

A notation of "VI" appears on the transcripts of students who successfully complete a course which they have elected to visit (audit). These courses do not count for degree credit requirements. Students who do not complete a course to the satisfaction of the instructor, and who have not dropped the course, receive a notation of "E" or "ED" (unofficial drop) on their transcript. This grade will be calculated into the student's GPA.

Satisfactory (S) and Unsatisfactory (U)

The department or program designates courses for which S/U grading is used. A student may, however, with permission from the advisor and the course instructor, elect S/U grading in a course that would otherwise be letter graded. Instructors cannot assign letter grades to students electing courses designated as S/U. A grade of "S" indicates that the instructor considers the student to have performed satisfactorily at the graduate level, and is counted toward the credit hour requirements of the degree program. A grade of "S" is considered to be a grade of "B" or better. A grade of "U" is assigned when a graduate student's level of performance is not acceptable, and is not counted toward a student's required credit hours. Grades of "S" and "U" are not converted into numbers, and are not factored into the Grade Point Average or Michigan Honors Points.

Incomplete (I)

A student may receive a grade of Incomplete ("I") only if the work remaining to be done for the course by the end of the semester is small and the instructor approves an extension for completing the unfinished work. The instructor must agree to this arrangement and determine a deadline for finishing the assigned work before a grade is assigned. The notation of "I" remains a permanent part of the academic record. When coursework is completed to the satisfaction of the instructor, the grade will appear on the transcript as, for example, "I B+." The grade point average is based only on hours of coursework completed.

Drops (W) and Unofficial Drops (ED)

A course that is officially dropped after the first three weeks of a full term (or the first two weeks of a half term), will be recorded with the notation of "W," and will not earn credit hours toward the degree program or Michigan Honor Points.

A student who registers for a course and either never attends or stops attending—but does not officially drop the course—receives a notation of "ED" (Unofficial Drop). A notation of "ED" is equivalent to a grade of "E" (failure). After the end of the term, but before the grade is posted, a student may petition to have a "W" recorded for the course. Students must complete an election worksheet, available from their department or program, or from the Registrar's Office at 1210 LSA Building, 500 S. State St., or at Pierpont Commons on North Campus.

Multi-Term Course (Y)

Departments may designate a graduate course as a multi-term sequence. The instructor may report a "Y" grade at the end of the first term to indicate that the work is still in progress. When a final grade is reported, the grade will be posted for both terms and the "Y" notation will be removed.

Students may access their unofficial transcripts or order official copies of their transcripts through [Wolverine Access](#).

Note: The Graduate School does not provide copies of academic records from other institutions. Students must obtain such records directly from the institution.

CORE COURSE EQUIVALENCE

NOTE TO STUDENT'S FILE:

_____ (student's name)
is requesting that

Course Name _____

Course Number _____

From _____ (University) be considered for equivalency

A grade of _____ was received for _____ credit hours.

The following items are attached:

1. Course description and/or outline
2. Textbook and handouts
3. Course notes taken by student
4. Homework assignments with graded student's solutions
5. Transcript verification

The appropriate equivalent University of Michigan course requested is:

Course Name _____ UM Course Number _____.

The materials listed above were reviewed for course equivalency. It _____ (is/is not) graduate level material. The approximate percent overlap between the proposed transfer credit course for the University of Michigan course, _____, is _____ (%).

Professor Bradford Orr
Director, Applied Physics

Date

5. SUPERVISED RESEARCH COURSE-APPPHYS 715

Non-thesis research under the supervision of Applied Physics affiliated faculty is a key ingredient of the Applied Physics Ph.D. Program. **Register for this course in the winter term of your first year.** Satisfactory completion of this 4-credit hour graded course is considered a core requirement. Prior approval by the program director must be obtained before beginning the supervised research course. A brief contract between you and your project advisor is mandatory, and will be kept in your file. Your progress in this project will be evaluated in detail at the completion of this course. Research group leaders commit to the program's goals for the course when they agree to supervise a student for their project. The goals and supervisory practices expected are part of this program document. See program administrator for a sample copy of a contract.

Practices and Goals:

1. At the beginning stage of the research project, the student and the supervisor lay out a critical path, which may be revised during the course. The plan should contain ample allowance for unexpected delays or additional work. One common reason for late completion of APPPHYS 715 is a slow start in the research project, resulting from lack of planning or clearly defined goals.
2. When research is carried out in a collaborative team setting, the necessity of meeting overall project deadlines and goals should not hinder the student's specific contribution to the work or unduly affect the time necessary to ensure the student's grasp of the project as a whole.
3. To balance between research and coursework studies, twenty laboratory hours per week devoted to the four-credit research course is a general guideline. The student should be made aware of the nature and pace of work that is expected and appropriate to the field of study.
4. Both parties need to keep systematic records. A clear and well-defined process of assessment allows the student to know where he or she stands, makes for a reasonably objective judgement of progress, and can be of value in detecting and correcting problems.
5. The student should know at various stages how well things are going, and must feel that the supervisor is providing proper direction. While there must be candid and open communication between supervisor and student, it is important to establish a regular time during which the student and supervisor meet to discuss progress and problems.
6. If possible, appropriate milestones should be established, determining the points, which the student should have reached at various times during the winter term. Fairly early in the project, the supervisor needs to assess whether it is likely that the student will be able to bring the work to a timely conclusion, or whether the timing is such that the student should consider extending the work into the summer session. If the work is to be extended in this way, the program director should be informed.

7. An "Incomplete" Grade is rendered at the end of the winter term when the project cannot be brought to a satisfactory conclusion by the end of this term. Circumstances such as laboratory equipment delays or difficulties balancing coursework and research may adversely impact the timing of the completion of the research. The research advisor should submit a grade revision form when the course is completed.
8. The timing of the Qualifiers in October allows for summer extensions of supervised research projects. (A brief oral presentation of the research is a part of the Qualifying Examination.)
9. Summer hourly appointments (funded by the research group) are often used to complete the work, or the student may acquire a Research Assistantship.
10. Research Assistantship offers/contracts must be in writing to avoid any misunderstandings.
11. Adequate time should be set aside for studying and preparing for Qualifier exams during the summer research sessions. The Director will hold study sessions beginning in late May.

Evaluations:

1. This supervised research course is the basis of a brief presentation at the beginning of the oral Qualifying Examinations. The oral exam assumes knowledge of general undergraduate level physics. The first 15 minutes (maximum) consists of a brief presentation of the physics involved in the student's supervised research project.
2. In addition to assigning a letter grade (A-E), the supervisor of the Applied Physics 715 course is requested to provide a brief note evaluating the student's research experience. The supervisor also completes a survey resulting in several numeric scores, which are averaged and made a part of the overall qualifying review process. Specific areas of focus on this survey are: Quantity of Work, Degree of Difficulty of Work Undertaken, Quality of Written Reports, Overall Evaluation of Directed Study, Knowledge of Field, Problem Solving Ability, Ability to Read and Comprehend Literature, Creativity, Productivity, Written Language Skills, Ability to Work and Learn Independently, Level of Effort, and Overall Research Promise.

Summary: In some fields, when the work has gone well and opened up prospects for future research, the supervisor may suggest that the student might like to consider continuation in the project as a graduate research assistant working toward a Ph.D. dissertation.

6. QUALIFYING EXAMINATIONS

Qualifying Procedure:

The Qualifying Examination is intended to evaluate the students' scholarly knowledge in physics, in their general area, their research potential, and ability to communicate. The students should be able to inter-relate various topics and concepts, to analyze problems, and to synthesize solutions. The decision to qualify a student for Ph.D. study is based on the student's academic record, performance in the four-credit hour supervised research project, and the results of the oral qualifying examination. **Applied Physics students are required to take the qualifying examination during their second year in the program.**

Oral Qualifying Examination:

The qualifying examination is an oral examination, beginning with a brief presentation of the students' supervised research followed by questions on standard undergraduate-level physics. A major purpose of the qualifying exam is to identify any gaps in a student's background and academic preparation that might affect future progress in research, so that corrective actions can be suggested.

The oral qualifying examination is administered by three faculty members and should be tailored to the students' general background. Questions should assume a general knowledge of undergraduate level physics and need not be confined to specific courses elected. Information on core courses and the students' backgrounds will be available to the examiners. The duration of the exam is normally one hour.

The examiners shall make every effort to put the students at ease; the first 15 minutes (maximum) of the exam will take the form of a brief presentation by the students of the physics of their supervised research experience. After the oral qualifying examination each examiner will submit an individual evaluation of the student's performance. An evaluation form is provided during the exam for this purpose.

Final Qualifying Decisions:

Final decisions are made by the Applied Physics Executive Committee and are based on scores from the oral exam, grade point average, and evaluations of the students' supervised research.

In some cases students are asked to retake the oral examination. Other recommendations might be to seek a teaching assistantship; to apply as a tutor in the Physics department or as a tutor in the Physics Help Room; in some cases students may be required to take additional courses to take care of gaps in their background.

The qualifying examination may be taken twice. The oral examination will be rescheduled usually with the same examiners for the following October.

The next step for students who pass the Qualifying Examination is to finish the course requirements and to proceed to the Preliminary Examination (see below) for their Ph.D. dissertation research.

A terminal Masters Degree in Applied Physics is available to students who do not qualify for the Applied Physics Ph.D. Program. Specific requirements for the Masters of Science in Applied Physics are covered in the next section of these Procedures.

7. MASTERS OF SCIENCE DEGREE

The Applied Physics Program is designed for students intending to pursue course work and research leading to the Ph.D. degree. Accordingly, students are not admitted as candidates for the Master of Science degree. Under certain circumstances students may elect to terminate their study early and would then be eligible for a Masters degree after they have satisfied certain requirements. An embedded masters degree has been approved by Rackham for students already in the program. They may earn a Master of Science Degree upon completing core course requirements while continuing on to the Ph.D. degree. Traditionally the embedded M.S. has been earned in Applied Physics or Electrical Engineering and Computer Science. Please see the director or program administrator for more information. **The minimum number of credits necessary for the masters degree: 30 credit hours.**

Up to six credit hours can be transferred from other graduate programs or universities subject to program approval. Specific course requirements call for at least 20 hours of graduate level courses from the Applied Physics core curriculum at the 500-level or higher. Students must attain at least a B average in order to satisfy requirements (see Grades, page 4). There are no language requirements, thesis/research essays, nor final examinations for the Masters degree.

Specific course requirements for the Masters Degree and MSH credits are (but not limited to):

3	Quantum Mechanics
3	Classical Mechanics
3	Electromagnetism
4	Supervised Research
8	4 semesters of Seminar Course: 2 (1 credit ea.) + 4 (2 credit ea.)
3	Statistical Mechanics
3	Condensed Matter or 500-600 level course of your choice
3	Computational/Math Methods Elective

Total = 30 Credits

A Masters of Science Degree Application is sent to Rackham by the student upon completion of the above requirements as approved by the program Director.

The Masters degree in Electrical Engineering and Computer Science (EECS) is also an option. Please look at their requirements and take the courses that are EECS instead of APPPHYS. Most of the Applied Physics courses are cross listed.

8. PRELIMINARY EXAMINATIONS

Rules for the Preliminary Examination, Dissertation Prospectus and Composition of the Dissertation Committee

Preliminary Examination: The purpose of the Preliminary Examination is primarily to assess students' preparation and plans for their Dissertation research. It is an oral examination and should consist of the following elements:

1. A brief review by the Committee of the courses taken by the student. A copy of the student's transcript (or other summary of courses and grades) should be available to each member of the committee prior to the oral exam. This discussion will most likely occur at the beginning of the examination without the student being present.
2. A presentation by the student of the plans for the dissertation research. The presentation should follow approximately the format of the Dissertation Prospectus (see below).
3. Questions asked during the Preliminary Examination will be at the discretion of the Committee and may include material not specifically related to the proposed thesis topic.

The Preliminary Examination is expected to last about one to one-half hours. There are four categories in which the Committee will classify the outcome of the Preliminary Examination:

1. Passed with Distinction
2. Passed
3. Passed with Reservations
4. Failed

If the third category is chosen the Chair of the Committee should provide a written statement to the program Director setting down the Committee's reservations, and recommendations (or requirements) which the student should satisfy, in a time frame to be decided by the Dissertation Committee. For Example, the student may appear to be weak in a particular subject, which is of direct importance to the proposed research. In such a case, the Committee shall recommend (or require) that the student takes additional course work, or do background reading and directed study in the area(s). The reservations of the Committee, and their recommended course of action will be transmitted to the student in writing by the program Director.

In the event the student fails the Preliminary Examination, the Chair of the Committee shall provide the program Director with a written summary of the Committee's decision giving pertinent details. The Preliminary Examination may be retaken one time only.

Dissertation Prospectus: The student will **present a copy of their Dissertation Prospectus to each member of the Dissertation Committee at least 10 days prior to the Preliminary Examination.** The Prospectus should describe the objectives of the proposed research, the methods to be used, a summary of previous work on the topic including pertinent literature and references, and give examples of any preliminary results or feasibility studies that are relevant to the project. The total length of the Prospectus should be less than 10 pages typed, double-spaced.

Composition of the Dissertation Committee: Dissertation Committees are subject to approval by the Applied Physics Program and by Rackham. The Rackham Student Handbook should be consulted for rules pertaining to general definitions and general requirements of the Rackham Graduate School that apply to Dissertation Committees in all of their Graduate Programs.

Rackham's Requirements: A summary of these basic requirements is as follows: Rackham requires a minimum of four members to serve on a Dissertation Committee, one of whom should be an 'outside member' not from the student's home department or program; the Chair, outside member, and at least one other member of the committee must be of professorial rank. Note that Rackham rules allow certain research staff to co-chair a committee but not to be a sole Chair (see Rackham Student Handbook). Also Rackham rules require that there must be at least two faculty members from the student's home department (i.e., program).

Applied Physics Requirements: In addition, there are stipulations that are specific to the Applied Physics Program. The Committee shall consist of five members. It is recommended that at least one member is a listed Applied Physics faculty member. Please see the program your advisor and the Applied Physics Director for committee recommendations and approval.

Report on the Preliminary Examination

_____ (date)

To: Bradford Orr, Director
Applied Physics Program

FROM: The Dissertation Committee of _____ (candidate's name)

We have examined the student named above as to background knowledge and preparation for dissertation research. We find that s/he has:

_____ Passed with Distinction
_____ Passed
_____ Passed with Reservations*
_____ Failed

In signing our names below we reassert our willingness to remain on the Dissertation Committee of this student

		Empl. ID
Chair:	_____	_____
Co-Chair	_____	_____
Members	_____	_____
	_____	_____
	_____	_____
	_____	_____

Allowance is made for one (and only one) member of the Committee to be absent from the examination. However, if the absent member wishes to remain on the Dissertation Committee, he/she should reassert a willingness to do so by signing as Absent Member

_____.

*Chair of Dissertation Committee to provide a letter summarizing the nature of the reservations and recommended course of action to remedy them.

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After all signatures have been made, please return this form to the Applied Physics' administrative office.

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