

GRADUATE STUDENT HANDBOOK

Department of Physics

Virginia Polytechnic Institute
and State University

August 2025

Note: The policies in this Handbook apply to students
entering Virginia Tech in Fall 2025 or later.

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General Policies and Procedures

The Physics department offers M.S. and Ph.D. degrees. Requirements vary, but the expectation is that the M.S. should be completed in two years and that the Ph.D. will require an average of five to six years past the B.S. degree in physics. The following regulations supplement the rules in the Graduate School Catalog and the Graduate School's Procedural Guidelines, see:

https://secure.graduateschool.vt.edu/graduate_catalog/

All entering students are expected to attend the Graduate School's Orientation Week according to the schedule provided by the Graduate School. Students holding Graduate Teaching Assistantships are required to attend a mandatory GTA workshop organized by the Graduate School (details are given in the Graduate School's orientation schedule). Failure to attend and comply with the GTA workshop's requirements could jeopardize possible GTA support.

All entering students are required to attend the Physics Department's graduate student orientation. Students will be informed of the date, time, and place of the Graduate School's GTA Workshop and the departmental orientation session once the departmental offer has been accepted by the student.

Each incoming student is assigned to a faculty member of the Graduate Committee who will serve as the student's *temporary* advisor. The faculty member will monitor the student's academic progress and will be available for advice and consultation. Students should meet monthly with their temporary advisor (scheduling meeting times are the students' responsibility). Students can only drop a class with their (temporary) advisor's and the Graduate Program Director's consent.

Academics

GENERAL REQUIREMENTS

The University requirements for the M.S. and Ph.D. degrees are stated in detail in the Graduate School catalog. They include course credits and submission of a *Plan of Study*.

All graduate students must submit a Plan of Study that meets at least the minimum Graduate School requirements for the designated degree. The Plan of Study must be approved by the student's advisor, the Graduate Program Director, and the Graduate School. All courses on the Plan of Study, including supporting courses, must be taken on a letter grade (A-F) basis except for those courses approved to be graded on a pass-fail (P/F) basis only. Audit courses cannot be included on the Plan of Study. After approval by the student's Advisory Committee and the Graduate Program, the Plan of Study will be entered and sent electronically to the Graduate School for approval, according to the following schedule.

M.S.: The Plan of Study is due by the end of the second academic semester for all master's degree students (based on full-time enrollment of 12 credits per semester).

For students in the Accelerated Undergraduate Graduate Degree Program in Physics the Plan of Study is due by the end of the first full semester of graduate study.

Ph.D.: The Plan of Study is due by the end of the third academic semester for all doctoral students (based on full time enrollment).

Transfer Courses on the Plan of Study. No more than 50% of the graded credit hours needed to satisfy the requirements for a Virginia Tech graduate degree may be transferred in from a regionally accredited university. All such credits must have earned letter grades "B+" or better, have been earned while in good standing in graduate student status, and must have been graduate courses (equivalent to Virginia Tech's courses numbered 5000-7000) at the institution where the student took these classes. Grades "S" or "P" are not acceptable for transfer credit. All transfer courses must be acceptable to the student's Advisory Committee and the Graduate Program Director. For transfer course work more than five years old, a Justification of Old Course Work form must be filed with the Plan of Study (see below).

Credits from other universities are transferred to a Virginia Tech graduate degree at the time the Plan of Study that includes those courses is approved by the Graduate School. Transferred courses count only as credit hours and are not included in the calculation of the Virginia Tech GPA. Official transcripts are required before transfer course work can be approved for the Plan of Study.

Transfer credits should be arranged with the Graduate Committee upon first arrival at Virginia Tech, but no later than the end of the student's first semester. Although a physics Ph.D. student may bypass the M.S. degree, all students are strongly encouraged to obtain at least the non-thesis M.S. degree when they have fulfilled the corresponding requirements.

Ph.D. Advisory Committee. The *Ph.D. Advisory Committee* should be composed of a minimum of four members. The advisory committee chair or co-chair and at least two of the committee members should be regular Virginia Tech physics faculty. The corresponding *M.S. committee* should have three members. The advisory committee chair or co-chair and at least one of the committee members should be regular Virginia Tech physics faculty. Any non-physics or non-VT faculty member needs to be approved by the Graduate Program

Director and the Graduate School for committee service.

Grades on Plan of Study Courses. All graded courses on the Plan of Study must be taken for a letter grade (A-F) except for those courses offered on a pass/fail (P/F) basis only (for example, Independent Study courses and many seminars are only P/F). Students must maintain a 3.0 GPA or better on the Plan of Study course work. Once a course on the Plan of Study is taken for a grade, it must remain on the Plan of Study (see below).

Repeating Courses on the Plan of Study. Students are required to repeat any courses on the Plan of Study in which a grade below "C-" has been earned. Courses may not be repeated if a "P" grade or a grade of "C" or better is earned. After a course has been repeated, the grade for the first enrollment will be Repeat Graduate (RG, defined as a C- or lower; RP, defined as a grade of C or higher when the course was first taken). Only the most recent enrollment in the course will receive a letter grade and be calculated in the student's GPA.

Graduate Honor System. All physics graduate students are bound by the rules of the University's *Graduate Honor System*, which is described in the Graduate School's catalog:

<https://graduateschool.vt.edu/academics/expectations.html>

Degree requirements. These include courses, both required and elective, thesis/dissertation research, and examination(s). The credit requirement for a Ph.D. is 92 hours, including a maximum of 60 hours of research and dissertation. For the M.S. degree there are two options, thesis and non-thesis, both of which require 32 credit hours.

PHYS 5944 Seminar Course. All first-year students are required to take the PHYS 5944 Seminar (1 hour, 1 credit, pass/fail) course, in the fall and the spring semester of their first year. In the fall semester, to pass, students are required to submit a brief note addressing their consultations with their prospective research advisor(s) and a written original research paper (roughly ten pages with specified format), including relevant literature. Students are expected to adhere to the standard rules and style of scientific writing (proper citations and references, no colloquialisms, etc.). The paper must give proper credit and cite all relevant sources. The paper can be based on work performed before enrolling at Virginia Tech but must in that case credit former collaborators and advisors. The student must be the sole author of the paper, which should be written after enrolling at Virginia Tech; an edited version of an older paper or report is not acceptable.

Learning outcomes: The paper will be graded on a 5-point scale for organization and originality.

In the Spring semester, the students are required to prepare and present a scientific poster (towards the end of the semester, usually the day before Reading Day) on the topic of the paper previously submitted, background for their planned research, or any recent (published within the last five years) journal articles. The topic of the student's choice should be on a level accessible to their fellow graduate students.

Learning outcomes: The paper will be graded on a 5-point scale for organization and delivery.

Requirements accompanying the specific degrees are discussed in the appropriate sections below.

Degrees in Physics

The following *five* physics courses constitute the *core courses*, required of students in both the M.S. and Ph.D. programs.

<u>Course No.</u>	<u>Title</u>	<u>Hours</u>
5354	Classical Mechanics	3
5405	Classical Electromagnetism 1	3
5455, 5456	Quantum Mechanics 1 + 2	6
5705	Statistical Mechanics	3
Total Course Hours		15

These are normally taken during the first year of graduate study (except for Quantum Mechanics 2 in the second-year Fall semester) and should be completed by the end of the second year. An overall GPA of 3.0 must be maintained in all courses (core and electives).

Master of Science (M.S.)

There are two options in this program: *non-thesis* and *thesis*. In the former option, only course work is required. In the latter, between 6 and 10 hours of research toward the M.S. thesis is required.

Course Requirements

The specific course requirements are:

Course No.	Title	Hrs.
	Core (five courses as detailed above)	15
5714	Methods of Theoretical Physics	3
5944	First-Year Seminar (two semesters)	2
	Electives (normally four courses)	12
Total Course Hours		32

Of the electives, up to 6 hours may be Independent Study (Physics 5974).

The Graduate Committee needs to approve any elective numbered below 5000 included in the Plan of Study.

M.S. Thesis

A student choosing the M.S. thesis option is encouraged to seek out as much information as possible about the activities of faculty members and their research groups before choosing a research advisor. M.S. theses completed in earlier years may serve as a guide. Students should communicate with each faculty member in whose work they may have a potential interest. Like the Ph.D. dissertation, an M.S. thesis represents a written communication of original research findings.

Final Examination

Every non-thesis M.S. and Ph.D. student must pass a *Qualifying Examination*. Please see page 10 for more details.

Students who complete an M.S. thesis must give an oral *M.S. Thesis Defense* of their original research (roughly comparable in content to a Ph.D. Preliminary Examination).

Learning outcomes: Students during the final M.S. Thesis Defense should demonstrate the ability to deliver the results of their original thesis work and answer related questions.

Doctor of Philosophy (Ph.D.)

Course Requirements

The *minimum* course requirements for the Ph.D. in physics are:

<u>Course No.</u>	<u>Title</u>	<u>Hours</u>
	Core (five courses as detailed above)	15
5714	Methods of Theoretical Physics	3
5944	First-Year Seminar (two semesters)	2
	Electives (usually four courses)	12
<hr/>		
Total Course Hours		32

All students are required to take 15 hours of physics graduate core courses and Methods of Theoretical Physics. Exceptions are granted (for those with appropriate qualifications or an M.S. degree), provided a student passes the final examination (or its equivalent) given in the preceding semester at Virginia Tech (with a grade “B+” or higher). If a student transfers with their faculty advisor to Virginia Tech, the Graduate Committee may waive the core course placement exam requirement.

According to the requirements of the Graduate School, a minimum of 60 hours of research credit may be counted towards the minimum of 92 hours necessary for the Ph.D. degree.

Ph.D. Committee

Students are encouraged to seek a potential Ph.D. thesis advisor as soon as possible after entering the program, and to form a *Ph.D. Advisory Committee* by the beginning of their third semester. The Advisory Committee will guide students in their original research and assist in their preparation for their Ph.D. preliminary and pre-defense exams.

Students will need to pass a *Qualifying Exam* during the fall semester of their second year. In case the student may retake the qualifying exam, it will be administered in the spring semester of their second year. Failure to pass the qualifying exam after two attempts will cause dismissal from the Ph.D. graduate program.

Annual Report

The University (Presidential Policy Memoranda No. 1 and No. 229) requires each department to evaluate each graduate student's performance and to provide them with constructive feedback annually. Regular evaluations help students understand what is expected of them, analyze their academic progress and scientific development, and guide them to meet higher performance targets. The Graduate School collects and files these evaluations annually.

Feedback should be candid, useful, constructive, timely, and fair.

Progress Portfolio. Each student shall submit an electronic progress portfolio every year. The portfolio documents the student's most recent calendar year of academic work, including research, courses, program milestones, and contributions to the department's teaching and outreach / service missions. The portfolio includes a one-page Self-Evaluation, a Student Activities Report, and a Research Update. These documents are prepared and submitted electronically in Canvas under the corresponding Assignment section.

Faculty Evaluation. Every faculty member shall submit a written evaluation of their own advisee's progress (deadline established each year by the Graduate Committee). Each student's progress portfolio should serve a valuable resource for the evaluation. The faculty member shall seek comment on the evaluation from the student's Advisory Committee.

Rating and Filing. The Graduate Committee will review progress portfolios and faculty evaluations (typically in April / May), assign each student a performance rating, and work with faculty members and students to address any perceived irregularities or other special concerns. After addressing any problems, all evaluation materials will become a permanent part of the student's record.

Examinations

Qualifying Examination

The *Qualifying Exam* is a two-hour oral examination on general physics at the upper undergraduate level. Students are expected to perform satisfactorily on the qualifying exam in order to obtain a non-thesis M.S. degree, or to be allowed to proceed toward a Ph.D.

The Qualifying Exam is offered once each semester. Students are required to attempt the Qualifying Exam by their third semester in the program. This time limit can be extended by written (email) request to the Graduate Program Director, if good cause is demonstrated. The Graduate Program Director will consider each student request on a case-by-case basis.

The Qualifying Exam takes place each semester on a weekend, typically in April in the Spring, and in November in the Fall. The date(s) will be announced early each semester. If a student cannot make the date, their exam may be rescheduled to an alternative date, provided a satisfactory reason is given. Foreseeable conflicts such as conference attendance will also be considered, provided the student contacts the qualifying exam committee immediately upon announcement of the date(s). Private reasons such as family events are typically not accepted.

If students fail their first attempt at the qualifying exam, they are allowed a second attempt which must be taken the subsequent semester, or by their fourth semester in the program if their first attempt had been earlier than the third. In the case of failure on the second attempt, the student will be considered as not making satisfactory progress toward their degree and thus will not be allowed to continue toward a Ph.D., but may remain in the program to obtain a thesis M.S. degree in physics.

The Qualifying Exam will be administered by members of the department's *Qualifying Exam Committee*. The student's research advisor will not be one of his or her examiners. Students will receive guidance and practice material by the end of their first year so that they can prepare for the Qualifying Exam.

These rules are designed to ensure that students pass the Qualifying Examination no later than by the end of their second academic year in the M.S. / Ph.D. program.

The time limits can be extended, at the discretion of the Graduate Program Director, but only if the extension is granted before the time limits have expired, and extenuating circumstances beyond the student's control exist.

Learning outcomes. The Qualifying Exam is an oral examination consisting of questions on general physics, at upper undergraduate level, the student is expected to have a firm and well-integrated understanding of undergraduate physics and the mathematical methods involved. Students are evaluated based on their knowledge on four distinct areas of physics on an individual 5-point scale. The evaluated areas are (1) classical mechanics, (2) quantum mechanics, (3) electricity and magnetism, and (4) modern physics / statistical mechanics.

Texts demonstrating the level and coverage of the material include:

- Baierlein, R., *Newtonian Dynamics* (McGraw-Hill)
- Symon, K. R. *Mechanics* (Addison-Wesley)
- Fowles & Cassiday, *Analytical Mechanics* (Thompson)
- Griffiths, *Introduction to Electrodynamics* (3rd Edition, Addison-Wesley)
- Lorrain, P., and Corson, D. R.,
Electromagnetic Fields and Waves (Freeman)
- Thornton, S. T., and Marion, J. B., *Classical Dynamics of Particles and Systems* (5th edition, Brooks Cole Publishing)
- Reitz, J. R., Milford, F. J. and Christy, R. W.,
Foundations of Electromagnetic Theory (Addison-Wesley)
- Griffiths, *Introduction to Quantum Mechanics* (2nd Edition, Addison-Wesley)
- Liboff, R. L., *Introductory Quantum Mechanics* (Addison-Wesley)
- Eisberg, R., and Resnick, R.,
Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles (Wiley)
- Krane, K. S., *Modern Physics* (Wiley)
- Tipler & Llewellyn, *Modern Physics* (W. H. Freeman)
- Young, *University Physics with Modern Physics* (12th Edition, Addison-Wesley)
- Giambattista & Richardson, *College Physics* (McGraw)
- Schroeder, Daniel V., *An Introduction to Thermal Physics* (Addison-Wesley)
- Baierlein, Ralph, *Thermal Physics* (Cambridge University Press)
- Cowan, Brian, *Topics in Statistical Mechanics* (Imperial College Press)
- Kittel, C. and Kroemer, H., *Thermal Physics* (W. H. Freeman)
- Hecht, E., *Optics* (4th Edition, Addison-Wesley)

Students are encouraged to seek a potential thesis advisor as soon as possible after entering the program, and to form a Ph.D. Advisory Committee by the start of their third semester. This will serve to prepare the students for the pre-defense exams, which consist of two equally important, independent parts:

- A) The *Ph.D. Preliminary Exam*, which consists of a presentation of and examination on the background material and preliminary research the student has performed.
- B) The *Ph.D. Pre-defense Exam*, which consists of a presentation of and examination of the work that the student has performed and the student's research achievements.

Both exams are oral and are expected to last approximately 1.5 hours each. Students must pass the qualifying exam before they can schedule the Preliminary Exam. Students are expected to perform satisfactorily on both exams to be allowed to proceed toward a Ph.D. Therefore, students must pass both exams before the Graduate School is informed that he or she has satisfied the requirements of the Preliminary Exam.

Students are required to attempt the preliminary examination no later than by the end of their fifth semester. This time limits can be extended by the graduate committee if good cause is demonstrated. Examples of reasons to extend time limits include (but are not limited to): debilitating medical conditions, medical conditions that require hospitalization, the birth of a child, data loss caused by technical failure. The committee will consider each student request on a case-by-case basis.

Students must form an Advisory Committee, consisting of their advisor and at least three other faculty, and complete a Plan of Study, before they can request a Prelim Exam. Faculty members from other departments are allowed to serve on student Advisory Committees.

These rules are designed to ensure that students pass the Preliminary Examination by the end of their third year. If a student fails to meet these time limits, he or she will not be allowed to continue toward a Ph.D. but may remain in the program to obtain a M.S. degree in Physics. The time limits can be extended, at the discretion of the Graduate Committee, but only if the extension is granted before the time limits have expired, and extenuating circumstances beyond the student's control exist. Failure to form an Advisory Committee in time to meet the limits is not grounds for an extension.

Ph.D. Preliminary Examination

The *Preliminary Exam* is a formal part of all doctoral programs at Virginia Tech. Students must read the relevant section of the Graduate Catalog:

https://secure.graduateschool.vt.edu/graduate_catalog/.

Please consult the section marked "Examinations" under the "policies" tab at the top of the page.

Purpose of the Prelim Exam. The Preliminary Examination determines whether a student demonstrates sufficient academic preparation, progress toward scholarly independence, accomplishment in research, and promise for future intellectual growth to justify continuing toward the doctoral degree. The oral exam format allows the Ph.D. Advisory Committee to assess these qualities in a single, vigorous session of direct, interactive questioning without recourse to textbooks, course notes, online databases, or other aid. Students should not expect their Ph.D. Committee members to "coach" them toward the right answers.

Enrollment. A Preliminary Exam can only be held during a term in which the student is enrolled. Therefore, the exam may not be held during a Summer Session unless the student has paid tuition (3 credits) for that session.

Two-Week Rule. Students must submit an exam request, at least two weeks prior to the exam date, through the Electronic Signature System (ESS):

<https://ess.graduateschool.vt.edu/pages/login.php>.

Reserving examination date, time, and location. Students must plan in advance to ensure that all committee members can attend the examination for the date and time requested. If any committee member does not approve the examination request, the student must resubmit the request. Identifying a room in the ESS does not reserve the room; students must reserve the room through the appropriate physics department staff or ask for help from the Graduate Coordinator.

Forms to Bring to the Exam. None. Your Graduate Coordinator should be informed and should be notified of the date and room in which the exam will be conducted. They will also check that the exam has been approved by the Graduate School.

The Prelim Exam may not be conducted if the student's Ph.D. advisor has not received notification from Graduate School that the exam has been scheduled. No exception to this policy is envisioned.

Latest Possible Prelim. Graduate School policy requires that students pass their Preliminary Exam at least six months before they plan to defend their dissertations. The target date for the Physics Department Prelim Exams is the end of the fifth semester of study. Students transferring from another university or who have joined the Ph.D. program after completing an M.S. thesis must pay special attention to this policy.

GPA Requirements. Graduate School policy allows departments to decide whether a student may take the Prelim Exam if the GPA is less than 3.0 or who have not completed all the graded (lecture) course work on their Plans of Study. At present the Physics Department allows only students with

- GPA of at least 3.0 in all courses;
- GPA of at least close to 3.0 in all core physics courses;
- a complete and approved plan of study;
- successful qualifying exam

to proceed to the Preliminary Exam.

Committee Attendance. Graduate School policy requires that the student's entire doctoral Advisory Committee attend the Prelim Exam. In order to pass the exam, the student may receive no more than one failing vote from among the members of the examining committee.

Substitute Committee Members: Graduate School policy allows a maximum of one member of your Examining Committee to be not a regular member of your Ph.D. Committee. This situation sometimes arises when one of your regular Ph.D. Committee members is on research or medical leave or is impossible to schedule. In this situation, the Chair of Ph.D. Committee (faculty advisor) in consultation with the Graduate Program Director should appoint a proxy. This appointment must be done in writing (e-mail message to the Graduate Program Director).

Those conducting the examination must log on to the Electronic Signature System and enter their decision on the exam result within two days after the exam. The proxy must communicate with the committee member for whom he or she is serving as a proxy regarding the exam result decision and the original committee member must log into the Electronic Signature System and enter the decision.

Professor Absent for the Exam. Graduate School policy does not address the issue of professors being absent from a student's Prelim Exam. However, sometimes a professor suddenly becomes unavailable immediately before a student's exam and a substitute cannot be found in time for the exam. (Rarely, a professor forgets about the exam, but students should seek to minimize that problem by sending timely reminders to their Ph.D. Committee members.) If the student still has four Examining Committee members present, then the exam can proceed. If not, then the exam must be rescheduled.

After an exam where a professor was absent, the Chair of the Ph.D. Advisory Committee must prepare a brief letter explaining the situation (an email message to the Graduate Program Director is sufficient).

Completion of Graded Course Work. Graduate School policy allows departments to decide how much of the student's graded course work must be completed prior to the Preliminary Exam. However, the Graduate School requires uncompleted courses scheduled for semesters prior to the Preliminary Exam to be explained. The student's physics core courses must all be successfully completed.

Time Allotted for Exam. Traditionally, the Physics Department has allowed two hours for each prelim exam. Students should consult their Faculty Advisor to see if a longer interval is needed. If you require special accommodation, please inform Services for Students with Disabilities as well as your Ph.D. committee chair.

Exam Coverage. The preliminary exam is partly a Literature Review document. Although the Research Plan is only a minor part of the document, it can play a very significant role in the Prelim Exam. In addition, the advisory committee will evaluate the student's research progress. Students should therefore prepare a presentation that combines the key points of their review and the highlights of their research progress. Because the Prelim Exam is also a comprehensive exam, students should expect questions of a general nature – often these will arise naturally during the discussion of the review or research results. The specific balance of the exam is left to the Ph.D. Advisory Committee to determine, and typically that decision depends on how the student responds to the first few questions asked during the exam.

Refreshments. Students should not bring refreshments to their exams. The Prelim Exam is a formal academic exercise.

Presentation format. Students should prepare their presentations in PowerPoint, pdf, or similar presentation software. A presentation of approximately 15...25 slides is suggested. Approximately half of those slides should summarize research progress, the remainder should address background and outlook. A lengthier presentation can cause the exam to exceed the allotted time. Students should consult their primary faculty advisor for further guidance.

Room Scheduling. Students should schedule an exam room by contacting the Physics Department main office at calendar@phys.vt.edu, with the date, time, and desired room. It is the student's responsibility to make sure that the LCD projector is functioning, their laptop can be connected to the projector, and the room can be unlocked and made available for use.

Reminding the Committee. Students should send an email reminder to their Ph.D. Advisory Committee members the day before the prelim exam.

Executing the Exam. Prelim Exams are not open to the public. Only the student and the Examining Committee should be present. In unusual cases, an additional observer (the Graduate Program Director or the Department Chair) may be present. The student's presentation, including the typically frequent interruptions, should consume about 45 minutes. Then the student can respond to additional questions (including general comprehensive questions) for about 15 minutes. A small interval should be left at the end for the Committee to confer and discuss the results of the exam. These proposed time intervals are rough guides. At the conclusion of the exam, the faculty advisor should input the exam result in the GSS online system.

Learning outcomes: Students will be evaluated based on literature review and delivery.

Ph.D. Pre-defense Examination

The *Pre-defense Exam* is a formal part of all doctoral programs at Virginia Tech. It is also a specific requirement of the Physics Department.

Purpose of the Pre-defense Exam. The Pre-defense Examination determines whether a student is ready to graduate and can demonstrate sufficient research achievements. The oral exam format allows the Ph.D. Advisory Committee to assess these qualities in a single, vigorous session of direct, interactive communication. Students should not expect their Ph.D. Committee members to “coach” them toward the right answers.

Enrollment. A Pre-defense exam can only be held during a term in which the student is enrolled. Therefore, the exam may not be held during a Summer Session unless the student has paid tuition (3 credits) for that session. Pre-defense exams can be held during the week of final exams.

Students must submit an exam request to their corresponding Ph.D. Advisory Committee prior to discussion and agreement with their research advisor. The research advisor will be responsible for the committee to fill out the appropriate form and then to send the completed form to the Graduate Program Coordinator.

Committee Attendance. Students must plan to ensure that all committee members can attend the examination for the date/time requested. Students must reserve the room through the appropriate physics department staff or ask for help from the Graduate Program Coordinator.

Forms to Bring to the Exam. Pre-defense form. The Graduate Program coordinator should be informed and should be notified of the date and room in which the exam will be conducted.

Committee Attendance. Same as for the Preliminary Exam.

Time Allotted for Exam. Traditionally, the Physics Department has allowed two hours for each post-prelim exam. Students should consult their Faculty Advisor to see if a longer interval is needed. If you require special accommodation, please inform Services for Students with Disabilities as well as your Ph.D. committee chair.

Exam Coverage. One year or so prior to the Ph.D. dissertation defense, students are expected to convene their advisory committee and present / report on their research progress and accomplishments, e.g., this could happen in the framework of a departmental seminar. The Ph.D. Advisory Committee members will also ask probing questions to determine if the student is on track to complete his or her thesis and defend within the next semester or so. Plans for completing the Ph.D. and writing a Ph.D. thesis should be presented and discussed with the Advisory Committee.

Refreshments. Students should not bring refreshments to their exams.

PowerPoint. Same as for the Preliminary Exam.

Room Scheduling. Same as for the Preliminary Exam.

Reminding the Committee. Students should send an email reminder to their Ph.D. Committee members the day before the Pre-defense Exam.

Executing the Exam. Same as for the preliminary exam.

Learning outcomes: Students will be evaluated based on the significance and originality of their research work performed, as well as the delivery of their research presentation.

Ph.D. Dissertation and Final Ph.D. Defense

For most graduate students, research is the most important and satisfying experience of their graduate education. Under the supervision of a member (or members) of the Advisory Committee, the student pursues original research in some area of physics, developing many of the skills necessary for a career in physics: proposing and defining a problem, carrying out the investigations and performing the analyses, as well as arriving at justifiable conclusion and communicating the results in both written (dissertation) and oral (final examination) forms.

Purpose of the Ph.D defense. The *Final Defense* determines whether a student has completed all requirements. The oral exam format allows the Ph.D. Committee to assess these qualities in a single, vigorous session of direct, interactive. Students should not expect their Ph.D. Advisory Committee members to “coach” them toward the right answers.

Requirements. In addition to completion of all coursework and program examinations, students must have at least two publications in peer-reviewed journals.

Enrollment. A Ph.D. Defense can only be held during a term in which the student is enrolled. Therefore, the exam may not be held during a Summer Session unless the student has paid tuition (1 credit hour) for that session under Start of Semester Defense Exception.

Manuscript submission. Students must submit a final draft of their Ph.D. dissertation, and an iThenticate similarity report, to the Program Director and all Ph.D. Advisory Committee members at least four weeks prior to their scheduled defense date. The Graduate Program Director will review the manuscript and approve the request to schedule the defense officially with the Graduate School.

Two-Week Rule. Students must submit an exam request, at least two weeks prior to the exam date, through the Electronic Signature System (ESS):

<https://ess.graduateschool.vt.edu/pages/login.php>.

Reserving examination date, time, and location. Students must plan to ensure that all committee members can attend the examination for the date/time requested. If any committee member does not approve the examination request, the student must resubmit the request. Identifying a room in the ESS does not reserve the room; students must reserve the room through the appropriate physics department staff or ask for help from the Graduate Program Coordinator.

Forms to Bring to the Exam. None. The Graduate Program Coordinator should be informed and should be notified of the date and room in which the exam will be conducted. They will also check that the exam has been approved by the Graduate School.

The Final Defense may not be conducted if the student's Ph.D. advisor has not received notification from the Graduate School that the exam has been scheduled. No exception to this policy is envisioned.

Committee Attendance. Same as for the Preliminary Exam.

Time Allotted for Exam. Traditionally, the Physics Department has allowed two hours for each Ph.D. defense. Students should consult their Faculty Advisor to see if a longer interval is needed. If you require special accommodation, please inform Services for Students with Disabilities as well as your Ph.D. committee chair.

Refreshments. Students should not bring refreshments to their exams.

PowerPoint. Same as for the Preliminary Exam.

Room Scheduling. Same as for the Preliminary Exam.

Reminding the Committee. Students should send an email reminder to their Ph.D. Advisory Committee members the day before the exam.

Executing the Exam. Same as for the Preliminary Exam.

Final ETD submission. After their final defense, students will have two weeks to update and submit their final electronic thesis and dissertation to the Graduate School using the ESS system. An iThenticate similarity report is required for submission. If the work in the dissertation manuscript contains previously published material, a publication right form will also be required.

Learning outcomes: Students will be evaluated based on the significance and originality of their research work performed, as well as the delivery of their research presentation.

Financial Support

Graduate Students entering the physics program may be granted financial support upon admission. Typically, this support is in the form of a *Graduate Teaching Assistantship* (GTA) appointment from the department. In subsequent years, students are often (partially) supported through a *Graduate Research Assistantship* (GRA) from their advisor's research group. In extraordinary cases, a research group may offer GRA support from the beginning.

Graduate/Teaching Assistant (GA/TA)

Incoming graduate students holding a *Graduate Teaching Assistantship* (GTA) must have attended the mandatory GTA training workshop. This program is designed to prepare the graduate students for their GTA duties. There are additional training sessions given by the faculty in charge of laboratories in the Department to which students be assigned. Students are required to attend these sessions as scheduled by their faculty advisors.

Teaching Assignments and Duties

Teaching assignments are made by the Physics Department's Associate Chair, in consultation with the Department Chair. The Physics Department expects graduate students who have accepted GTA positions to take their teaching responsibility very seriously and conduct themselves professionally. GTAs should each hold at least one office hour per week when they can meet with their students. Lab instructors will hold orientation meetings with students who have laboratory assignments. Lab GTAs must work through the laboratory assignments before they meet their sections.

The nominal service required for a full GTA can be up to, but should not exceed, 20 hours per week. The activities included are preparation, grading, office hours, and other student contact. The estimated time allotted for the completion of each task should be agreed upon before the semester begins. The instructor of the course and the Associate Chair should be informed as soon as possible if these estimates are not according to the guidelines given above.

Eligibility for and Duration of Support

To be eligible for such support by the department in the following year, a regular student in any graduate program in physics must satisfy the following criteria for Minimum Academic Progress in the current year:

- Year 1: pass 5354, 5405, 5455, 5705 (physics core courses), and 5714 (Methods of Theoretical Physics) with GPA ≥ 3.0 , total GPA ≥ 3.0 ; pass PHYS 5944 (seminar course).
- Year 2: (M.S.) no support is provided beyond the second year; (Ph.D.) pass 5456 (physics core course) with GPA ≥ 3.0 (total GPA ≥ 3.0) and the qualifying examination.
- Years 3 and 4 (Ph.D.): pass preliminary examination and present one seminar on progress with research.

Priority for support will be given to those students with a physics core GPAs ≥ 3.0 . Students enrolled in the M.S. program may be supported beyond the second year if they switch to the Ph.D. program. In this case, the Graduate Committee must be informed in writing by December 1st of the second year. For Ph.D. students, GTA support is not normally provided beyond the fifth year. Exceptions will be considered by the Graduate Committee, on a case-by-case basis.

The Instructor of Record will set the guidelines and expectations for the GTA and this will vary from instructor to instructor.

Protocol for reporting. Reports of misconduct, complaints, and even accolades must be filed to the Graduate Program Director by the instructor of record, who is the TA's direct supervisor for the course.

Unsatisfactory performance reports for TAs may be filed at any time during the semester by the instructor of record to the Graduate Program Director. The report consists of an Unsatisfactory Performance Evaluation form, which will become part of the student's record; therefore, it should sufficiently detail the issues such that an outside observer could clearly interpret the reasons for the unsatisfactory review.

The form can be found at the following [link](#).

Reporting Outcomes:

One unsatisfactory report will result in:

- (1) Notification of the student's advisor that an unsatisfactory evaluation has been reported and
- (2) a one-on-one meeting between the Graduate Program Director and the TA during which the issues that resulted in the infraction will be discussed and a solution to the problem identified and (hopefully) implemented. The solution will be provided to the TA and the instructor in writing and include specific actions and a timeline for implementation. Particularly serious infractions may require a follow-up meeting with the Chair of the Department or other officials.
- (3) The report will be discussed and the Graduate Program Director will decide if it will be filed and constitute the first unsatisfactory report or if there were just communication issues, in this case the report will not be filed.

A second unsatisfactory report, during the same or subsequent semesters, will result in a meeting between the TA, the GPD, the instructor of record, the student's research advisor, and the Chair of the Physics Department.

Repercussions for two unsatisfactory reports may range from change of duties to termination of the Teaching Assistantship for the current and subsequent semesters. The specific actions will be determined by the Chair of the Physics Department and the Graduate Program Director and be communicated in writing.

Unsatisfactory ratings on the semester reports will trigger the same responses as outlined above, with two unsatisfactory reports during consecutive semesters resulting in a meeting between the TA, the Graduate Program Director, the student's research advisor, and the Department Chair.

The department recognizes the potential of all students to improve, correct mistakes, and overcome challenges in serving as a GTA. Therefore, an unsatisfactory performance report will be purged from students' records after two semesters of "satisfactory" teaching performance, as indicated in the Department's annual review of GTA performance.

Research Assistant (RA)

A *Graduate Research Assistant* is supported by individual faculty members or research groups. The duties are specified by the research supervisor. Although there are exceptions, RAs are usually offered to students that have passed the Preliminary Examinations. Students on RA support during the academic year when they are signed up for research credit hours should fulfill both the obligations of the RA support and their credit hour requirements. Details should be discussed with their research advisor and may vary.

All students are encouraged to seek RA support as early as possible in their graduate careers.

Graduate Honor System

All students are expected to abide by the *Graduate Honor System*. The Graduate Honor Code establishes a standard of academic integrity that all graduate students at Virginia Tech are expected to uphold. You are encouraged to familiarize yourself with it. Details are available at:

<https://graduateschool.vt.edu/academics/expectations.html>

Graduate Committee

The Department's *Graduate Committee* consists of faculty members, two student representatives, and Graduate Program Coordinator Betty Wilkins. Graduate students who have concerns about any aspect of the graduate program are encouraged to speak to any member of this committee.

At present, the faculty and staff members of the Graduate Committee are:

Giti Khodaparast

Danielle Lucero

Djordje Minic

Kyungwha Park

Hans Robinson

Leo Piilonen

Eric Sharpe

Vicki Soghomonian

Uwe C. Täuber (Graduate Program Director)

Tatsu Takeuchi (Chair, Qualifying Exam Committee)

Betty Wilkins (Graduate Program Coordinator)

Graduate Student Representatives

The Graduate Committee has two graduate student members, who serve as voting members for a period of two years. At the time of appointment, the students must have passed the Preliminary Examination. Prior to the beginning of each academic year, the graduate student body will elect a new student representative. The selected students will be the representatives of the graduate student body for the current and successive academic year in which they were elected.

Current graduate student representatives:

Debra Dunham

Andrew Gustafson

Admission to the Graduate School

Admission to the Graduate School is contingent upon receipt of a BS / BA degree from an accredited university or college, an undergraduate cumulative grade point average of 3.0 / 4.0, and presentation of evidence of potential to do graduate work. Specifically, 20 credit hours of physics courses, excluding general physics and including modern and thermal physics and junior / senior level mechanics, electricity and magnetism, and quantum mechanics; a grade point average in physics and math of at least 3.0 (“B”) during the last two years; and mathematics courses covering vector calculus and partial differential equations are required. Students who lack any prerequisite courses may be considered for admission but will have to remedy the deficiencies during their first year of graduate study.

International students must take the TOEFL. A minimum score of 90 iBT is required by the Graduate School.

Prior to submitting the online application, individuals are encouraged to review the requirements and conditions for admission. Applications for admission should be made on-line at:

<https://applyto.graduateschool.vt.edu/pages/login.php>

The TOEFL score (where applicable) should be sent directly to the Graduate School (please instruct ETS to have your scores sent to institution code 5859. PLEASE do NOT enter a department code). A completed application consists of the on-line application form, uploaded official up-to-date transcripts of all undergraduate and graduate work from institutions from which you received a degree, ETS scores, three letters of recommendation, and a \$75 non-refundable application fee (unless waived).

Uploading a transcript

While completing your online application and prior to submitting it, you will be required to upload one copy of your scanned official transcript from each institution from which you have earned or will earn an undergraduate or graduate degree. Do not send transcripts for community college attendance or from any institution where you enrolled in classes but did not earn a degree.

Make sure your scanned documents are legible BEFORE uploading. Non-legible documents will not be accepted.

You may scan a copy of your official paper or electronic transcript provided to you from your institution’s Registrar. Do **NOT** upload your institution's web-based academic record or a document stating it is not an official transcript. Make sure that **all** critical and identifying marks have been scanned and are legible. These include the institution's name, your name, the names of your courses and the grades you have received. It is important that you scan both the front and back of your transcript as we will need to be able to review the information provided on the back of your transcript concerning credit hours, the institution's grading scale, etc. Please ensure that your file is in Word (.doc) or PDF format.

The process of uploading transcripts is intended to eliminate the need for you to mail in your transcripts, as our departments will be able to review your application based on your uploaded transcripts. If you are admitted to the program, you will be required to provide an official copy of your transcript(s) upon the awarding of your degree and its posting to your transcript prior to your enrollment at Virginia Tech.

Virginia Tech reserves the right to rescind any offer of admission if any discrepancies are found between your uploaded and official transcript(s).

If offered admission, you will be required to submit your final official transcript showing degree conferral to the Graduate School (not the Physics Department) upon enrollment.

Virginia Tech does not discriminate against employees, students, or applicants based on race, color, sex, sexual orientation, disability, age, veteran status, national origin, religion, or political affiliation. The university is subject to title VI and VII of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, Sections 503 and 504 of the Rehabilitation Act of 1973, the Age Discrimination in Employment Act, the Vietnam Era Veteran Readjustment Assistance Act of 1974, Federal Executive Order 11246, Governor Allen's State Executive Order Number Two, and all other rules and regulations that are applicable. Anyone with questions concerning any of these regulations should contact the Equal Opportunity/Affirmative Action office.

Virginia Tech's Title IX coordinator: Angela Catena. Contact: angelamc@vt.edu; (540) 231 1824.

Physics Personnel

For an updated list of all physics faculty, research faculty, instructors, and staff, please refer to: <http://www.phys.vt.edu/People.html>.

Student Resources on Campus

4Help (online or by phone): If you need to reset your password or have trouble logging on to university online services, such as Canvas or Hokie SPA.

The Graduate School (Graduate Life Center): Can help with any university-specific graduate education questions.

Cranwell International Center (Harper Hall): Advisors there handle all questions relating to immigration, including I-20 extensions and OPT requests.

Graduate Ombudsperson (GLC): Acting as an advocate for fairness, the ombudsperson provides information about institutional policies and works to help individuals effectively navigate conflicts.

Student Medical Insurance Office (Student Services Building): Provides information regarding signing up for the subsidized student health insurance plan and how to add additional policies, such as dental insurance.

Schiffert Health Center (next to McComas gym): Provides basic health care to students who have paid their student fee.

Cook Counseling (Gilbert Place): Cook Counseling offers one-on-one and group therapy sessions to students.

Women' Center at Virginia Tech (206 Washington St.): The center serves as a resource for the university and surrounding community on gender-related and women's issues; sponsors educational programs and events that raise awareness of women's issues; and serves as an on-campus focal point for services for survivors, their friends and families.

Services for Students with Disabilities (Lavery Hall): Provides accommodations and services to students with disabilities and temporary illnesses or injuries.

Cultural and Community Centers (Squires Student Center): Advocates for a safe, inclusive environment and advises students as they navigate life at VT.

Centers include: Ati:Wa:oki Indigenous Community Center, Asian Cultural Engagement Center, Black Cultural Center, El Centro Hispanic and Latinx Cultural Center, and the Pride Center

Hokie Passport Office (Student Services Building): Obtain new student ID; deposit money onto Hokie Passport account to use on campus and around town.

Parking Services (505 Beamer Way): You must register your vehicle and purchase a parking permit to park on campus. This is where you would go to obtain a permit, appeal a citation, or pay a ticket.