

# MIT Department of Nuclear Science and Engineering

## Master of Science Degree Requirements

### Summary:

66 units of graduate subjects.

- Undergraduate subjects may not be counted.
- English proficiency subjects also may not be counted.
- No more than 12 units of special problems (22.901-22.904) may be counted.
- Research subjects (thesis and 22.94) may not be counted.

48 of the 66 units must be taken within the NSE Department.

- Special problems may not be counted.
- Two modules (selected from 22.11, 22.12, 22.13, 22.14, 22.15, 22.16) are required. These 12 units constitute part of the 48 unit NSE subject requirement.

Cumulative GPA of 3.5 exclusive of thesis is required to qualify for the Master's degree.

- Average of coursework + thesis must also be at least 3.5.

Master's Thesis (see below for more information)

- Must have an NSE faculty member as either thesis supervisor or thesis reader. Senior or Principle Research Scientists (whether NSE or not) are allowed, but require an NSE faculty member as the thesis reader.
- A *thesis prospectus* must be submitted during the first term that a student is registered for thesis (deadlines will be emailed, but roughly halfway through the term).

### Self-Evaluation Exam

All incoming graduate students are expected to take the self-evaluation exam, in order to determine which coursework is appropriate for the Fall term. It is acceptable for incoming graduate students to enroll in 1-2 undergraduate subjects should their self-evaluation indicate that they could use strengthening in that area of the curriculum, or if their prior studies did not include an area of nuclear science and engineering (many students come from non-nuclear educational backgrounds). The undergraduate subjects will not count toward the degree requirements, but if taken for a letter grade, will count toward the cumulative GPA. Taking an undergraduate class as a Listener is also permitted.

Students should plan programs of study with their Registration Officers, keeping in mind prior educational background and principal professional interests. Typically, Master's students register for around 24-45 units every term, including thesis. 18-24 months is the typical time to earn the degree.

### Required Subjects for the S.M. Degree

Two modules (selected from 22.11, 22.12, 22.13, 22.14, 22.15, 22.16) are **required** for all Master's degree candidates. Other subjects may be selected in accordance with the student's particular field of interest. Most Master's candidates specialize in one of four alternative fields: fission nuclear technology, applied plasma physics, nuclear security, or nuclear science and technology.

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Last update: March 18, 2021. Applies to students entering June 1, 2021 or later.

### **Recommended Subjects for the S.M. Degree (specializations)**

- Nuclear Reactor Engineering: 22.211, 22.312, and one of (22.39, 22.313, or 22.315)
- Nuclear Reactor Physics: 22.211, 22.312 and one of (22.212, 22.213, or 22.251)
- Nuclear Materials: 22.71, 3.20 (thermodynamics) and one of (22.72, 22.73, 22.74, 22.76 or 3.21 (kinetics))
- Fusion: 22.611, 22.62, and one of (22.63, 22.612, 22.615, 22.616 or 22.67)
- Nuclear Science and Technology: 22.51, 8.511 and one of (22.90, 8.333, or 8.421)
- Nuclear Security and Policy: 6.431, 22.90, + one specialist subject by petition

### **Master's Thesis Research**

Research may be undertaken in nuclear engineering or in a related field. A Master's thesis is normally completed within 12-18 months. Students should use this as a guide in planning their research schedule. No student will be allowed to register for more than three semesters of Master's thesis work without petitioning for and receiving the express consent of the Departmental Committee on Graduate Students. Once initiated, a Master's thesis must be completed before a student may start doctoral research.

### ***Department Regulations for Thesis Supervision – who is allowed to supervise a thesis:***

- **NSE FACULTY** (NSE faculty; NSE faculty emeritus; NSE professor of practice; faculty having dual and joint appointments with other departments).
- **Non-NSE MIT Faculty and NSE (and affiliated labs — PSFC and MITR) Senior and Principal Research Scientists/Engineers.** This case requires an NSE faculty member as a thesis reader.
- **Visiting Professors, NSE (and affiliated labs — PSFC and MITR) Research Scientists/Engineers, and MIT Senior and Principal Scientists/Engineers (including MIT-Harvard programs).** This case requires approval from the NSE Graduate Committee and requires an NSE faculty member as a thesis reader.

### ***Thesis Prospectus***

Each thesis student is required to turn in one copy of a brief (5-10 pages) thesis prospectus to the Department Academic Office by the end of the eighth week of the first term of Master's thesis registration. Thesis registration may be cancelled if this requirement is not satisfied.

The prospectus should be a clear and well-organized preliminary report. It should contain:

- (1) an introduction to the subject, giving a brief general statement of the field of interest and a concrete statement of the limited area of work which it is intended to undertake;
- (2) a review of relevant background information;
- (3) the proposed method of solution;
- (4) a tentative time schedule for completion of the work;
- (5) the name of the faculty member who will act as thesis advisor, and reader to be selected by the student with the concurrence of the advisor;
- (6) signatures of thesis advisor and reader to indicate approval of the proposed research project. Either the thesis advisor or the reader must be a member of the faculty of the Nuclear Science and Engineering Department.

### ***Thesis Progress***

- It is the responsibility of the student to maintain a rate of progress that will ensure completion of the thesis within the three semesters allowed.

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- The student must meet with all members of their thesis committee at least once annually. A committee progress report form must be signed by supervisor, reader and student at the end of the meeting (or set of meetings), and it is the responsibility of the student to submit the form to the NSE Academic Office (in person or electronically). The student or committee may request that a second meeting take place within 6 months of the primary meeting. This additional meeting can be a series of individual meetings with each member of the committee, or a series of discussions with subsets of the committee members, and should be organized by the student.
- The thesis supervisor may require periodic, written reports on the progress of the thesis. Students should be prepared to submit these if requested.

### *Thesis Submission*

Each graduate student preparing a thesis is responsible for compliance with Institute and Department instructions regarding thesis preparation. See (<http://libraries.mit.edu/archives/thesis-specs/>).

Prior to submission of the final written thesis, a draft complete in all particulars is required for editorial comment and professional appraisals by the supervisor and reader. In planning a schedule, the student should realize that in excess of one month has customarily been required to complete the editorial comment, professional appraisal, required revisions and review.

### *Use of Publications in the Thesis Document*

Students who wish to incorporate prior publications into their thesis can include publications as appendices in the thesis (with permission from the publisher), and can cite them extensively. However, it is necessary to maintain a consistent voice and single authorship in the PhD thesis. Most papers are multi-authored, including the student's advisor. It is hard to separate who wrote what. PhD thesis must be single-authored by the student. So, unless the publications are truly single-authored by the student alone, they cannot form the main chapters. It is also necessary for a thesis to have a "grand theme" and a consistent notation. Just putting together papers of disparate topics together without the linkages is not acceptable. It is important to ensure there are enough technical details in the thesis - because of page limitations, most papers are more concise than thesis. NSE expects a thesis that is detailed enough. Students are in no way obligated to include prior publications in the thesis.

Please review the NSE Graduation Checklist to ensure that you submit all required materials, including your final thesis document and all required forms and surveys. Questions can be directed to the Academic Office.

Copies of the final thesis should also be distributed to your supervision committee, sponsor and/or fellowship donor, in whatever format they prefer.

### **SM to PhD (for students admitted as SM)**

A student admitted for a SM degree must apply for admission to the doctoral degree program, using the online application system in the regular cycle, should the student become interested in a doctoral degree. Note that all pre-qualifying exam requirements for the doctoral degree program must be met before taking the qualifying exam, and the student must have a minimum 4.0 GPA (based on the 5.0 scale).