

## MIT Department of Nuclear Science and Engineering

### Nuclear Engineer Degree Requirements

#### Summary:

162 units of graduate subjects, more advanced than undergraduate preparatory subjects.

- Undergraduate subjects may not be counted.
- 8.04, 18.075, or English proficiency subjects also may not be counted.
- No more than 24 units of special problems (22.901-22.904) may be counted.
- Research subjects (thesis and 22.94) may not be counted.
- Up to 66 equivalent units of graduate credit obtained at other institutions (graduate level coursework) may be transferred to partially satisfy the 162 unit requirement.
- 22.11 and 22.12 are required for all NSE Master's and Engineer's degrees.

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

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

Engineer'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).

Note: Students satisfying the Engineer's degree requirements will be simultaneously approved for the SM degree.

#### Self-Assessment Exam

All incoming graduate students are expected to take the self-assessment 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-assessment 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, Engineer's students register for 24-45 units every term, including thesis.

#### Required Subjects for the N.E. Degree

**22.11** and **22.12** are required for **all** Engineer's degree candidates. Other subjects may be selected in accordance with the student's particular field of interest.

Each Nuclear Engineer's degree program is individually arranged. A list of subjects to be used to satisfy the 162 unit requirements, approved by the Registration Officer, is due to the Academic Office during the first term of registration.

## **Recommended Subjects for Specializations (optional)**

### **Fission nuclear technology**

- 22.211 Nuclear Reactor Physics I
- 22.312 Engineering of Nuclear Reactors
- 22.38 Probability and Its Applications to Reliability, Quality Control, and Risk Assessment
- 22.71J *or* Modern Physical Metallurgy *or*
- 22.74 Radiation Damage and Effects in Nuclear Materials

### **Applied plasma physics or fusion technology**

- 22.611J Introduction to Plasma Physics I
- 22.615 MHD Theory of Fusion Systems
- 22.62 Fusion Energy
- 22.63 Engineering Principles for Fusion Reactors
- 22.67 Principles of Plasma Diagnostics

### **Nuclear security**

- 22.16 *or* Nuclear Technology and Society *or*
- 22.04 Social Problems of Nuclear Energy
- 22.251 Systems Analysis of the Nuclear Fuel Cycle
- 22.78 Principles of Nuclear Chemical Engineering and Waste Management
- 22.812J Managing Nuclear Technology
- 22.814 Nuclear Non-Proliferation
- 22.90 Nuclear Science and Engineering Laboratory

### **Nuclear science and technology**

- 22.51 Quantum Theory of Radiation Interactions
- 22.55J Radiation Biophysics
- 22.56J Noninvasive Imaging in Biology and Medicine
- 22.90 Nuclear Science and Engineering Laboratory

## **N.E. Thesis Research**

Research may be undertaken in nuclear engineering or in a related field. The thesis required for the Engineer's degree represents a more extensive project than the normal Master's thesis. A substantial Master's thesis may be accepted partly or wholly in place of the Engineer's thesis. If the student's SM thesis is judged too limited to satisfy the departmental requirements for the Engineer's degree, the student may extend its scope by registering for a special problem, units of which simultaneously apply to the 162 hour total and thesis credit. The written special problem report in this case would serve as the Engineer's written thesis and therefore should be a comprehensive report of the subject investigation. It should summarize the previous work on the topic presented in the Master's thesis and conform in all editorial and administrative respects to the requirements for the SM thesis.

A thesis supervisor may be selected from one of three categories (NSE faculty; non-NSE faculty and NSE Senior/Principle Research Scientists/Engineers; all other allowable faculty and research scientist/engineer staff). Either the thesis supervisor or reader must be a member of the faculty of the Nuclear Science and Engineering Department. A thesis can be primarily theoretical or experimental, or can combine both approaches.

### **Department Regulations for SM Thesis Supervision**

The following was adopted by the NSE Graduate Committee.

A **thesis supervisor** may be selected from one of the following three categories:

1. **NSE FACULTY** (NSE faculty; NSE faculty emeritus; NSE professor of the practice; faculty having dual and joint appointment with other departments).
2. **Non-NSE MIT Faculty and NSE (and affiliated labs — PSFC and MITR) Senior and Principal Research Scientists/Engineers.** A selection from category (2) requires an NSE faculty member as a thesis reader.
3. **Visiting Professors, NSE (and affiliated labs — PSFC and MITR) Research Scientists/Engineers, and MIT Senior and Principal Scientists/Engineers (including MIT-Harvard programs).** A selection from category (3) requires an NSE faculty member as a thesis reader.

### ***Thesis Prospectus***

Each thesis student is required to turn in one copy of a brief thesis prospectus to the Department Academic Office by the end of the eighth week of the first term of 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 insure completion of the thesis within the three semesters allowed.
- The student, thesis supervisor, and reader must have a formal meeting once per academic year. An committee progress report form must be signed by supervisor, reader and student at the end of the meeting, and it is the responsibility of the student to submit the form to the NSE Academic Office (in person or electronically).
- The thesis supervisor may require periodic, written reports on the progress of the thesis. Students should be prepared to submit these if requested.

### **Thesis Defense and Thesis Document Preparation**

*At least one week prior to the scheduled thesis defense, students must submit electronically*

- the draft thesis document
- the executive summary document
- notice of the thesis defense should be attached to the front of the executive summary document and should list the names of the committee members, date, time, and place of the scheduled defense
- approval from the thesis supervisor for both of the above documents
- student may not advertise the thesis defense until informed by the Academic Office that all materials have been received and approved

### ***Thesis Defense***

- The candidate will be examined on the content of the thesis and on topics immediately related to it. The thesis defense may be scheduled to occur at any time after eight days have elapsed following submission of the thesis to the NSE academic office, in conformity with Institute and Department requirements for thesis presentation, but before the date grades are due for that term.
- The candidate shall arrange a time for the defense to meet the convenience of the thesis defense examining committee.
- The examining committee shall include at least three members of the MIT faculty (of whom the supervisor(s) and reader may be two).
- The chairman of the committee shall be an NSE faculty member who is not a supervisor or reader.
- Thesis defense examinations are open to the public.
- A notice of thesis defense must be emailed to all NSE faculty, staff and students at least one week prior to presentation.
- The chairman of the thesis defense committee will inform the NSE academic office of the result of the defense. Acceptance will be endorsed by the signatures of the supervisor and reader on the thesis title page after the thesis defense.

### ***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/>).

Submission of the final approved thesis document

- Ensure that the thesis meets all of the thesis specifications prior to printing. (See above.) In particular, pay attention to: title page <http://libraries.mit.edu/archives/thesis-specs/images/titlepgex.pdf> and abstract page <http://libraries.mit.edu/archives/thesis-specs/images/abstractex.pdf>.
- Two copies of the thesis in final printed form, on approved archival bond paper, must be submitted to the Academic Office.
- Original signatures of the thesis supervisor and reader must appear on the thesis cover page. In addition, a copy should be furnished the thesis advisor, the reader if requested, and to satisfy any other obligations incurred (e.g., sometimes copies are required for non-government fellowship sponsors.)
- One electronic copy must be submitted to the Department Academic Office.
- One electronic copy must be submitted to the DSpace archive.
- If graduating, the Departmental Checklist must also be submitted.

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

A student admitted for an NE degree must apply to the NSE Department Admissions Committee for admission to the doctoral degree program, 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).