# DOCTOR OF PHILOSOPHY IN NUCLEAR SCIENCE AND ENGINEERING

Department of Nuclear Science and Engineering ([http://catalog.mit.edu/schools/engineering/nuclear-science-engineering/#phd-dsc](http://catalog.mit.edu/schools/engineering/nuclear-science-engineering/#phd-dsc))

## Program Requirements

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<th>Core Modules</th>
<th>requirement</th>
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<td>22.11</td>
<td>Applied Nuclear Physics</td>
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<td>22.12</td>
<td>Radiation Interactions, Control, and Measurement</td>
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<td>22.13</td>
<td>Nuclear Energy Systems</td>
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<td>Materials in Nuclear Engineering</td>
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<td>Essential Numerical Methods</td>
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<td>22.16</td>
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<th>Field of Specialization (choose one)</th>
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### Nuclear Reactor Engineering

- 22.211 Nuclear Reactor Physics I
- 22.312 Engineering of Nuclear Reactors

**Plus one of the following subjects:**

- 22.313[J] Thermal Hydraulics in Power Technology
- 22.315 Applied Computational Fluid Dynamics and Heat Transfer
- 22.39 Integration of Reactor Design, Operations, and Safety

### Nuclear Reactor Physics

- 22.211 Nuclear Reactor Physics I
- 22.312 Engineering of Nuclear Reactors

**Plus one of the following subjects:**

- 22.212 Nuclear Reactor Analysis II
- 22.213 Nuclear Reactor Physics III
- 22.251 Systems Analysis of the Nuclear Fuel Cycle

### Nuclear Materials

- 3.20 Materials at Equilibrium
- 22.71[J] Modern Physical Metallurgy

**Plus one of the following subjects:**

- 3.21 Kinetic Processes in Materials
- 22.72 Corrosion: The Environmental Degradation of Materials
- 22.73[J] Defects in Materials
- 22.74[J] Radiation Damage and Effects in Nuclear Materials
- 22.76[J] Ionics and Its Applications

### Fusion

- 22.611[J] Introduction to Plasma Physics I
- 22.62 Fusion Energy

**Plus one of the following subjects:**

- 22.63 Engineering Principles for Fusion Reactors
- 2.612 Marine Power and Propulsion
- 22.615 MHD Theory of Fusion Systems
- 22.67[J] Principles of Plasma Diagnostics

### Nuclear Science and Technology

- 8.511 Theory of Solids I
- 22.51[J] Quantum Technology and Devices

**Plus one of the following subjects:**

- 22.91 Nuclear Science and Engineering Laboratory
- 8.333 Statistical Mechanics I
- 8.421 Atomic and Optical Physics I

### Nuclear Security and Policy

- 6.3702 Introduction to Probability
- 22.90 Nuclear Science and Engineering Laboratory

**Plus one specialist subject by petition**

### Advanced Subjects

- Two advanced subjects closely related to the doctoral thesis topic. May not overlap with the student’s field of specialization but can be from a different field of specialization.

### Minor Subjects

- Two coordinated graduate subjects, or three undergraduate subjects taken while a graduate student in the department, outside the field of specialization and area of thesis research.

| 22.94 | Research in Nuclear Science and Engineering | 24 |
| 22.THG | Graduate Thesis | 36 |
| 22.911 | Seminar in Nuclear Science and Engineering | 3 |

### Total Units

**183**

Note: Students in this program can choose to receive the Doctor of Philosophy or the Doctor of Science in Nuclear Science and Engineering or in another departmental field of specialization. Students receiving veterans benefits must select the degree they wish to receive prior to program certification with the Veterans Administration.
Students may take the Core Module coursework or register as a Listener and take only the final exam. Students must complete all core module final exams by the end of the fourth term and are allowed one retake. A final exam GPA of 4.5 is needed to clearly pass the written qualifier. A final exam GPA of 4.0–4.5 will require faculty review prior to the student embarking on doctoral research. Students earning a final exam GPA below 4.0 will not be permitted to progress further in the doctoral program.

Students may also petition for a unique field of specialization.

Students must register for research or thesis until they complete appropriate milestones, including passing the doctoral qualifying process, submitting an approved thesis prospectus, defending the thesis, and submission of a final, approved thesis document. The units here represent a minimum, not a typical or maximum number of units.

Students must register for 22.911 each term that they register for thesis, except the final semester in which they plan to defend their thesis.