

## DOCTOR OF PHILOSOPHY IN NUCLEAR SCIENCE AND ENGINEERING

Department of Nuclear Science and Engineering (<https://catalog.mit.edu/schools/engineering/nuclear-science-engineering/#phd-dsc>)

### Program Requirements

#### Core Subjects

22.101	Applied Nuclear Physics	12
22.102	Applications of Nuclear Science and Engineering	3

22.103	Nuclear Technology and Society	9
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**Field of Specialization (choose one)<sup>1</sup> 36**

#### Nuclear Reactor Engineering

22.211	Nuclear Reactor Physics I
22.312	Engineering of Nuclear Reactors

*Plus one of the following subjects:*

22.313[[]]	Thermal Hydraulics in Power Technology
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22.315	Applied Computational Fluid Dynamics and Heat Transfer
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22.39	Integration of Reactor Design, Operations, and Safety
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#### 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
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22.213	Nuclear Reactor Physics III
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22.251	Systems Analysis of the Nuclear Fuel Cycle
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#### Nuclear Materials

3.20	Materials at Equilibrium
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22.71[[]]	Modern Physical Metallurgy
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*Plus one of the following subjects:*

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

22.611[[]]	Introduction to Plasma Physics I
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22.62	Fusion Energy
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*Plus one of the following subjects:*

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

22.611[[]]	Introduction to Plasma Physics I
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22.62	Fusion Energy
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*Plus one of the following subjects:*

22.211	Nuclear Reactor Physics I
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22.71[[]]	Modern Physical Metallurgy
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22.74[[]]	Radiation Damage and Effects in Nuclear Materials
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22.312	Engineering of Nuclear Reactors
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#### Quantum Science and Engineering

8.511	Theory of Solids I
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22.51[[]]	Quantum Technology and Devices
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*Plus one of the following subjects:*

22.52	Quantum Theory of Materials Characterization
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8.333	Statistical Mechanics I
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8.421	Atomic and Optical Physics I
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#### Nuclear Security and Policy

6.3702	Introduction to Probability
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22.90	Nuclear Science and Engineering Laboratory
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Plus one specialist subject by petition

**Advanced Subjects 24**

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.

**NSE Breadth Requirement 12**

One NSE subject outside the field of specialization.

**Unrestricted Elective 12**

#### Graduate Research

22.911	Seminar in Nuclear Science and Engineering <sup>2</sup>	3
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22.THG	Graduate Thesis <sup>3</sup>	84
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**Total Units 195**

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.

- <sup>1</sup> *Students may also petition for a unique field of specialization.*
- <sup>2</sup> *Students must register for 22.911 each term, starting the fall term after completing the qualifying milestones, except the final semester in which they plan to defend their thesis.*
- <sup>3</sup> *Students must register for graduate thesis until they complete all degree requirements, including 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.*