

Nuclear Science and Engineering Exploration Subjects

22.015: Radiation and Life: Applications of Radiation Sources in Medicine, Research, and Industry (3 units, Fall term)

Introduces students to the basics of ionizing and non-ionizing radiation; radiation safety and protection; and an overview of the variety of health physics applications. Presents basic physics of ionizing and non-ionizing radiation, known effects of the human body, and the techniques to measure those effects. Common radiation-based medical imaging techniques and therapies discussed. Projects, demonstrations, and experiments introduce students to standard techniques and practices in typical medical and MIT research lab environments where radiation is used.

22.016: Seminar in Fusion and Plasma Physics (1 unit, Fall term)

What are the outstanding challenges on the path to fusion energy? What is plasma physics? Why are nuclear science, computer science, and materials science so important for fusion? What undergraduate classes help you prepare to study fusion in graduate school? Covers a range of plasma and fusion energy topics, including discussion of the Global Energy Picture, Basic Plasma Physics, the Physics of Fusion, Fusion Reactors, Tokamaks and Inertial Confinement Facilities. Includes tours of MIT laboratories at the Plasma Science and Fusion Center.



For more information, contact:
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NSE Undergraduate Administrator
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“ I liked that a smaller department meant there were no strangers and I worked with everyone in my class. ”

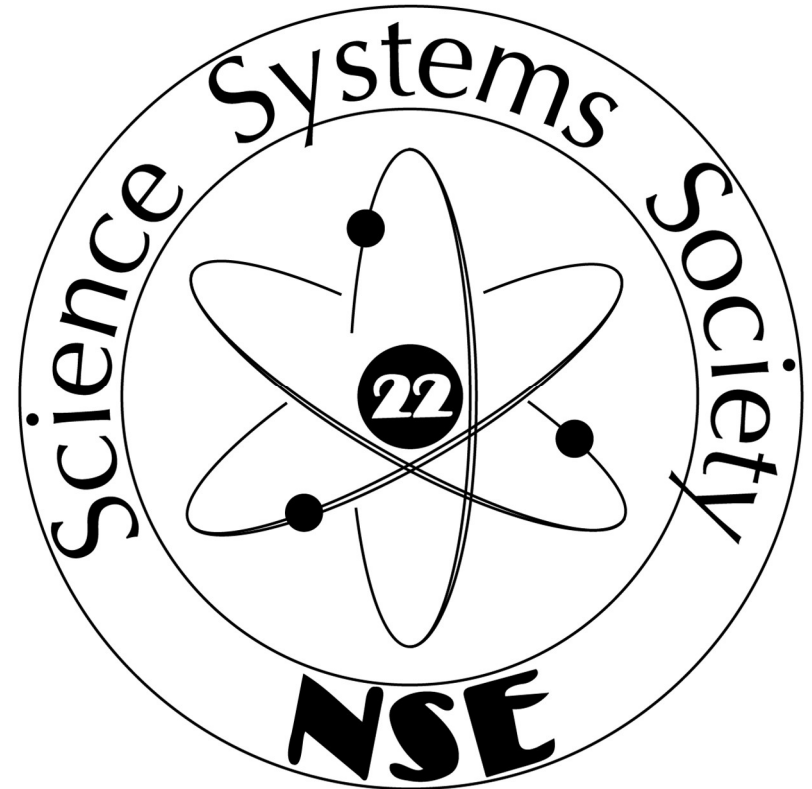
- NSE Alum

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NSE

Nuclear Science and Engineering

science : systems : society



Major, Minor, or UROP in Course 22
Unique opportunities for 1st year UROPS

Course 22

The best of both worlds: Take advantage of all of the benefits of a small department AND the vast resources of a world class institution.

A Smaller Department Means

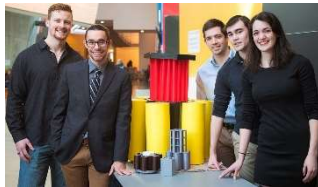
- academic opportunities like flexible degrees, hands-on approach to education, and professional development opportunities
- greater access to 1-1 guidance from dept head, faculty, and NSE staff
- vibrant student community and leadership opportunities in NSE's ANS student chapter, and Women in NSE



Departmental Resources and Opportunities include

Undergraduate Research Opportunities Program (UROP)

brings NSE faculty, research staff, and students together on cutting-edge research. Get hands-on experience, for credit or pay – first-year students included- NO EXPERIENCE NECESSARY unless otherwise noted



NSE's Departmental Communications Lab, led by Erika Reinfeld, in partnership with MIT's Gordon Leadership Program, facilitates NSE's focus on practical professional communication skills, offers peer-to-peer teaching opportunities, and integrates CommLab workshops into several classes.

NSE Departmental Investment in Cross-Disciplinary Centers and Initiatives, like the MIT Energy Initiative (MITeI) and NEET, give students opportunities to explore applications of nuclear engineering across the institute.

NSE's Commitment to Undergraduate Quality of Life

- NSE's DEI Committee has representatives from faculty, staff, undergraduate, and graduate students and is working on improving equity and community within the department.
- A dedicated undergraduate lounge provides space and facilities for students to study, collaborate, eat, rest and socialize.
- Outstanding, award-winning NSE staff provide guidance and support.

Follow us on Social Media:

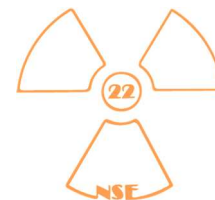
YouTube Channel:

<https://www.youtube.com/@mitdepartmentofnuclearscie6484>



Instagram Handle:
mitnse

Meet the NSE Student Social Media Hosts



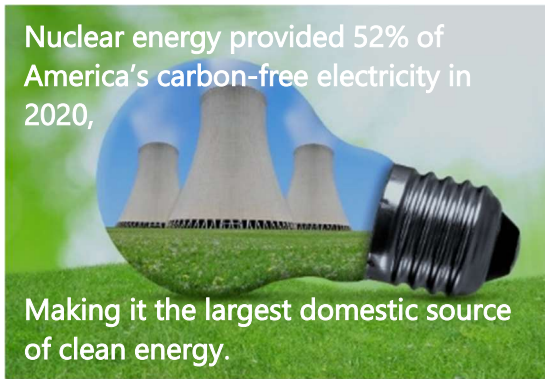
“Our vision is a sustainable future. Work starts now. Period.”

- Anne White

Associate Provost

Women in NSE Faculty Advisor

Help solve grand challenges for the benefit of society and the environment



- Clean Energy
- Fighting Climate Change
- Quantum Computing
- Food Safety
- Clean Water
- Improving Human Health

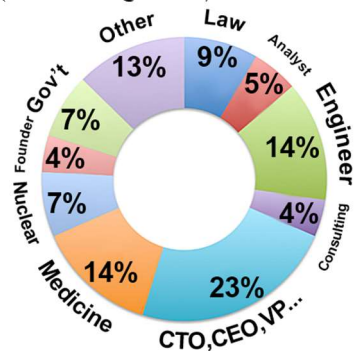
Where will an NSE degree take me?

“The rigorous education I received at MIT in Nuclear set me up for success” - NSE Alum

Graduate School: Roughly 65% of NSE undergrads to on to graduate study

Professions: Nuclear Engineering, Law, Business, Finance, Medicine, Public Sector.... In any sector, NSE Undergraduate Alumni redefine “traditional”

Career Paths for NSE Graduation (excluding PhD)



Nuclear Engineers

Median annual wages, May 2020



Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Occupational Employment and Wage Statistics

NSE degrees prepare alums for a globally competitive job market. Nuclear Engineers earn higher median salaries than other engineers and other occupations.

Minor in Nuclear Science and Engineering

This minor allows students from any major outside of Course 22 to delve deeper into advanced topics within the department or to support interdisciplinary areas of interest in nuclear science and engineering.

Required Subjects

- 18.03 Differential Equations
- 22.01 Introduction to Nuclear Engineering and Ionizing Radiation

NSE Electives (select two of the following)

- 22.02 Introduction to Applied Nuclear Physics
- 22.033 Nuclear Systems Design Project
- 22.05 Neutron Science and Reactor Physics
- 22.06 Engineering of Nuclear Systems
- 22.09 Principles of Nuclear Radiation Measurement and Protection

Foundation and Specialized Subjects

- | | |
|---|---|
| Option 1: | Option 2: |
| 2.005 Thermal-Fluids Engineering ¹ | 24 units of Course 22 coursework ² |
| or 8.03 Physics III | |
| 12 units of course 22 coursework ² | |

Total Units

Notes: ¹ Subject has prerequisites that are outside the program

² Selected subjects must be letter-graded. Research/UROP subjects cannot be used

Fifth Year Master's Degree Option

Students complete one year of graduate study, usually after completion of their Bachelor's Degree classes, and graduate with a Master of Science degree in addition to the Bachelor's degree after the fifth year. Advantages of this program include:

1. Requires only one thesis. Bachelor's and master's degree theses are combined.
2. Earlier assurance of graduate admission allows better planning for senior and graduate years.
3. Provides better preparation for either further graduate study or employment.
4. Employers may place a higher value on the Master's degree than on the SB alone.

“The diverse range of topics in the NSE undergraduate degree prepared me to work on interesting energy problems which combine multiple disciplines.” - NSE Alum

Undergraduate Degree Programs

Our core discipline combines engineering, modern physics, mathematics and computational skills configured in either a structured or flexible program.

Common Requirements

Core Subjects

- 18.03 Differential Equations**, 12
- 22.01 Intro to Nuclear Eng. & Ionizing Radiation**, 12
- 22.04 Social Problems of Nuclear Energy (HASS-S)**
- 2.005 Thermal-Fluids Engineering I**, 12
- 22.09 Principles of Nuclear Radiation Measurement & Protection**, 15 (CI-M)

Computational Requirement, 12 units, one of:

- 1.000 Intro to Programming & Numerical Methods
- 2.086 Numerical Computation for Mechanical Eng.
- 12.010 Comp Methods of Scientific Programming
- 22.C25 Real World Computation with Julia
- 6.100A + 6.100B Intro Computer Sci. & Programming

Math Elective Requirement, 12 units, one of:

- 6.3700 Probabilistic Systems Analysis (6.041)
- 18.04 Complex Variables with Applications
- 18.05 Introduction to Probability and Statistics
- 18.06 Linear Algebra
- 18.075 Methods for Scientists and Engineers
- 18.600 Probability and Random Variables

Bachelor of Science in Nuclear Science and Engineering/Course 22

Degree-specific Requirements

- 22.02 Introduction to Applied Nuclear Physics**, 12
- 22.033 Nuclear Systems Design Project**, 15
- 22.05 Neutron Science and Reactor Physics**, 12; pre: 18.03, 22.01, math elective
- 22.06 Engineering of Nuclear Systems**, 12; pre: 2.005
- 22.061 Fusion Energy**, 12; pre: 22.01
- 22.ThT Undergraduate Thesis Tutorial**, 3 units
- 22.ThU Undergraduate Thesis**, 9+ units, CI-M; pre or co: 22.ThT

Materials Science and Physics Elective, one of:

- 1.050 Solid Mechanics**, 12, pre: Physics I (GIR), Calculus II (GIR)
- 2.001 Mechanics and Materials I**, 12, co: 2.087 or 18.03
- 3.010 Structure of Materials**, 12, pre: Chemistry (GIR); co: 18.03
- 3.013 Mechanics of Materials**, 12, pre: Physics I (GIR); co: 18.03
- 8.03 Physics III**, 12, REST; pre: Physics II (GIR), Calculus II (GIR)

Restricted Electives in NSE: 12 UNITS (*graduate subjects may be petitioned*)

- 22.022 Quantum Theory of Radiation Interaction, 12, 22.02
- 22.039 Integration of Reactor Design, Ops & Safety, 12, 22.05 and 22.06
- 22.051 Systems Analysis of the Nuclear Fuel Cycle, 12, 22.05
- 22.055 Radiation Biophysics, 12
- 22.071 Electronics, Signals & Measurement
- 22.072 Corrosion: The Environmental Degradation of Materials, 12
- 22.081J Sustainable Energy, 12
- 2.006 Thermal-Fluids Engineering II, 12, 2.005 or 2.051
- 3.14 Physical Metallurgy, 12, 3.022 and 3.032

Unrestricted Electives

48

Total Units Beyond the GIRs Required for SB Degree

186

Bachelor of Science in Engineering/Course 22-ENG (the Flexible Track)

Degree-specific Requirements

System Specialization, one of:

- **22.06 Engineering of Nuclear Systems**, 12; pre: 2.005
- **22.061 Fusion Energy**, 12; pre: 22.01

Senior Project, one of:

- **22.ThT Thesis Prep + 22.ThU Undergraduate Thesis**, 15 units total
- **22.033 Nuclear Systems Design Project**, 15

Focus Area

Choose your own individual focus area & the subjects to fulfill it.

72 units, self-selected and approved via proposal to the department

Examples:

- Fusion/Nuclear Physics:** 8.03, 8.04, 8.07, 8.21, 8.276, 6.013, 22.611, 22.02
- Medical Applications:** 5.60, 8.241, 20.110/2.772, 20.310/3.053, 6.003, 20.345
- Energy Systems:** 22.071, 8.21, 15.2191 or 14.44*, 1.020, 22.081, 2.60, EC.711
- Modeling & Simulation:** 22.00, 6.034, 6.041, 6.009, 6.031, 6.036, IDS.013
- Policy & Economics:** STS.082, 17.393, 1.286, 14.44*, 14.42*, 12.348, 12.349
- Quantum Science:** 22.02, 8.03, 8.04, 8.05, 8.06, 8.223, 22.022
- Quantum Computing:** 2.110, 8.370, 3.021, 18.436, 6.042, 6.045, 18.404
- Nuclear Materials:** 3.012, 3.014, 3.032, 3.042, 22.074, 22.054, 3.14, 3.18

Unrestricted Electives

48

Total Units Beyond the GIRs Required for SB Degree

186