# Environmental Science and Engineering

A combination of both science and engineering, the Graduate Certificate in Environmental Science and Engineering at NJIT helps students solve environmental issues from both a scientific point of view as well as from an engineering point of view. The program will ultimately force a mathematical mindset to employ the scientific method when monitoring and solving real world environmental issues.

**Who would be suited to take this program?**

Due to the nature of engineering courses, one would want to possess an engineering background in order to be eligible for this program. Participants are typically employees of major corporations, government agencies, private consulting and construction firms, and universities.

**What will I learn?**

- ***Environmental Chemical Science* -** Principles of physical, inorganic and organic chemistry are applied to understanding the origins of environmental pollutants, their transport, distribution and decomposition pathways.
- ***Environmental Analysis*** - The analysis of environmental samples is studied from the acquisition of representative samples, through sample handling, chain of custody, sample storage, analytical method selection, analysis, and data treatment.
- ***Environmental Problem Solving*** - Solutions for current environmental problems. Students are asked to respond to an imaginary Request for Proposal (RFP) in writing and before a team of technical experts at an oral presentation. Solutions proposed in student RFPs must reflect knowledge of environmental science and technology in current use.
- ***Global Environmental Problems*** - Relationships of the earth's temperature balance, global air circulation patterns, global energy needs, and control and remediation technologies.
- ***Toxicology*** - The assessment of acute, sub-acute and chronic effects of hazardous and toxic chemicals. Qualitative and quantitative measures of toxicity and testing protocols are addressed. The role of toxicology in risk assessment and risk management is discussed.
- ***Environmental Microbiology* -** 1) basic microbiology: biochemical principles, cell structure organization, microbial nutrition and growth, 2) the important microbes involved in environmental microbiology and address the environments where they are found, and 3) how they are detected and monitored, and their effects on humans, and the environment.
- ***Energy and Sustainability* -** Energy fundamentals including the basic principles necessary to understand energy systems. The technological and engineered systems for processing and using different energy non-renewable and renewable sources. The social and environmental consequences of energy production, distribution, and use, including a comparison of socioeconomic models of global energy applications.
- ***Legal Aspects in Environmental Engineering* -** Control of air, water, and solid waste pollution by federal, state, and local government statutes and international law. Preparation of environmental impact statements and the right of private citizens to bring suit under federal clean air and water pollution legislation are discussed, as well as limitations on these rights.
- ***Sustainable Politics and Policy* -** Sustainability development and institutional efforts to implement strategies at various geopolitical scales: international, national, regional, and local. The course introduces tools to measure progress toward sustainability through the use of metrics such as ecological footprint analysis and life-cycle analysis.
- ***Physical Processes of Environmental Systems* -** Physical processes in various media (open water, porous media) under various hydraulic regimes (laminar and turbulent). Transport by diffusion, convection, and dispersion is considered along with absorption.
- ***Environmental Microbiology* -** Microbiology of natural and human impacted environment, fundamental microbiology in water treatment engineering, microbial detection methodologies, waterborne disease outbreaks, microbial risk assessment, biotechnologies for renewable energy, and other emerging topics
- ***Site Remediation* -** Regulations, cleanup standards, remedial investigations, feasibility studies, risk assessment, and safety. Established and innovative cleanup technologies such as incineration, containment, bioremediation, vapor extraction and ground water recovery.
- ***Physical and Chemical Treatment* -** Physical and chemical operations and processes employed in the treatment of water and wastewater. Gas transfer, coagulation, flocculation, solid-liquid separation, filtration, and disinfection.
- ***Biological Treatment* -** Principles of evaluation and control of water pollution that describe aerobic treatment processes such as oxidation ponds, trickling filters, and activated sludge; and anaerobic processes, and sludge handling and disposal as wall as biodegradability study techniques for various wastes.
- ***Environmental Impact Analysis* -** Environmental problems, federal and state standards, methodology for developing impact statements, case studies based on recent experience, basis for assessment and decision making.

- ***Stormwater Management* -** With an emphasis on design practices, you will learn regulatory framework, an overview of structural and non-structural BMPs, groundwater recharge analysis, estimate of runoff, and design of detention basin and drainage systems.
- ***Geotechnical Aspects of Solid Waste* -** municipal landfill, dredged materials, coal and incinerator ashes, identification and classification of waste materials, geological criteria for siting, laboratory and field testing, design for impoundment and isolation of waste, methods of stability analyses of landfill sites, techniques for stabilizing waste sites, leachate and gas collection and venting systems.

**Why study Environmental Science and Engineering at NJIT?**

This hybrid program allows for individuals to learn from both a theoretical point of view as well as a practical one. Students will learn to develop sustainable solutions to environmental problems, preparing to work with regional, national and global communities to protect the environment and improve water quality. Jobs in this field are essential in planning, designing and constructing water and wastewater treatment plants, solid waste disposal systems, site remediation approaches and emission control measures.

**Into what industries might holders of this program find employment?**

- Federal/State/Local Department of Environmental Protection (e.g., USDEP, NJDEP)
- Private consulting company conducting audits/reviews in environmental science
- Medical Centers
- Junior Civil Engineer
- Sr. Transportation Engineering Manager
- Hydrologist

**Prerequisites**

Applicants should have a bachelor's degree from an accredited institution with some undergraduate background in a related field (biology, chemistry, environmental science, environmental engineering, mathematics, etc.).

**Related Degree Programs**

Depending on the courses selected, coursework would apply to either the NJIT MS in Environmental Science (https://catalog.njit.edu/graduate/science-liberal-arts/chemistry-environmental-science/environmental-science-ms/) or the NJIT MS in Environmental Enginering (https://catalog.njit.edu/graduate/newark-college-engineering/civil-environmental/environmental-ms/).

**What are the Required Courses?**

| Code | Title | Credits |
|---|---|---|
| **Core Courses: choose four (4) courses in total, two (2) courses from each group.** | | **12** |
| Select two (2) of the following: | | 6 |
| EVSC 610 (http://catalog.njit.edu/search/?P=EVSC%20610) | Environmental Chemical Science | |
| EVSC 612 (http://catalog.njit.edu/search/?P=EVSC%20612) | Environmental Analysis | |
| EVSC 613 (http://catalog.njit.edu/search/?P=EVSC%20613) | Environmental Problem Solving | |
| EVSC 615 (http://catalog.njit.edu/search/?P=EVSC%20615) | Global Environmental Problems | |
| EVSC 616 (http://catalog.njit.edu/search/?P=EVSC%20616) | Toxicology | |
| EVSC 627 (http://catalog.njit.edu/search/?P=EVSC%20627) | Environmental Microbiology | |
| EVSC 715 (http://catalog.njit.edu/search/?P=EVSC%20715) | Energy and Sustainability | |
| EM 631 (http://catalog.njit.edu/search/?P=EM%20631) | Legal Aspects in Environmental Engineering | |
| EPS 622 (http://catalog.njit.edu/search/?P=EPS%20622) | Sustainable Politics and Policy | |
| Select two (2) of the following: | | 6 |
| ENE 630 (http://catalog.njit.edu/search/?P=ENE%20630) | Physical Processes of Env Syst. | |

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| ENE 661 (http://catalog.njit.edu/search/?P=ENE%20661) | Environmental Microbiology |
| ENE 662 (http://catalog.njit.edu/search/?P=ENE%20662) | Site Remediation |
| ENE 664 (http://catalog.njit.edu/search/?P=ENE%20664) | Physical and Chemical Treatment |
| ENE 665 (http://catalog.njit.edu/search/?P=ENE%20665) | Biological Treatment |
| ENE 671 (http://catalog.njit.edu/search/?P=ENE%20671) | Environmental Impact Analysis |
| ENE 672 (http://catalog.njit.edu/search/?P=ENE%20672) | Stormwater Management |
| CE 647 (http://catalog.njit.edu/search/?P=CE%20647) | Geotechnical Aspects of Solid Waste |
| EM 631 (http://catalog.njit.edu/search/?P=EM%20631) | Legal Aspects in Environmental Engineering |