Structural Engineering

Structural Engineering Graduate Certificate

The Structural Engineering certificate provides a strong foundation and detailed technical knowledge in design and construction of structures. This is a 12-credit certificate.

Who would be suited to take this program?

Students and professionals interested in the area of Structural Engineering. The design and construction of structures require both a deep understanding of theoretical concepts and detailed knowledge of practices. Graduates of the program will be well positioned to understand and design variety of key structures.

What are the prerequisites?

Applicants should have a bachelor's degree from an accredited institution in either Civil Engineering, Civil Technology, Mechanical Engineering, Mathematics, Physics, or have relevant experience.

NJIT’s standard admission requirements apply to this graduate certificate.

What will I learn?

The certificate provides expertise to analyze, design and construction of infrastructure. Graduates of the program use in-depth knowledge analyze, design and construction of infrastructure to ensure that the infrastructure is designed and implemented with the best practices in mind. This requires the ability to perform sophisticated analysis and design, coupled with the ability to perform forensic analysis. It also requires the ability to develop and maintain tools and technologies to enhance the design and construction of infrastructure.

Why Study Structural Engineering at NJIT?

NJIT is situated in Newark, minutes from Newark Penn Station. Jersey City and New York City are also a short train ride away, providing easy access to these commercial areas with many companies that employ Structural Engineers. NJIT is a top 100 university, classified as R1 very high research activity, with faculty performing cutting-edge research and publishing in top venues. NJIT also consistently ranks highly on added-value and diversity.

Into what industries might holders of this program find employment?

Modern building and infrastructure systems require a new workforce that comes from trained structural engineer who can analyze, design and construct such systems. Positions in the industry include:

- Assistant Engineer
- Structural Engineer
- Forensic Engineer
- Bridge Engineer
- Project Engineer
- Project Manager

Related Degree Programs

Credits from this graduate certificate can be applied toward the NJIT MS in Civil Engineering (Structural Concentration) degree.

COURSE DESCRIPTIONS

CE 630. Matrix Analysis of Structures. 3 credits, 3 contact hours.

A review of matrix operations and energy methods, and development of flexibility and stiffness methods used in linear-elastic structural analysis. Behavior of continuous beams, plane trusses, space trusses, and frames are studied.

CE 631. Advanced Reinforced Concrete Design. 3 credits, 3 contact hours.

Prerequisites: an undergraduate course in theory and design of reinforced concrete. A review of basic concepts of elastic and ultimate strength theories and a study of the present design codes. Topics include design of concrete building frames, two-way slabs, flat slabs, deep beams, and other structural elements using the above two theories.

CE 632. Prestressed Concrete Design. 3 credits, 3 contact hours.

Prerequisites: undergraduate course in theory and design of reinforced concrete. Analysis and design of pre-tensioned and post-tensioned prestressed concrete elements for both determinate and indeterminate structures will be studied. Examples of prestressed elements used in buildings and bridges will be discussed, as well as the source and magnitude of prestress losses.

CE 634. Structural Dynamics. 3 credits, 3 contact hours.

Prerequisite: undergraduate course in structural analysis. Dynamic analysis of beams, frames, and other types of structures. Practical methods developed are applied to problems such as the analysis of the effects of earthquakes on buildings and moving loads on bridges.

CE 636. Mechanics and Stability of Structures. 3 credits, 3 contact hours.

Prerequisite: undergraduate course in theory of structural analysis. Topics include structural design concept; stability criteria; elastic and inelastic buckling; column buckling; lateral buckling of beams; stability of frames; stability of plates and shell; local buckling and post-buckling.

CE 637. Short Span Bridge Design. 3 credits, 3 contact hours.

Prerequisites: undergraduate courses in steel design and concrete design, and some knowledge of prestressed concrete fundamentals. Design and performance of highway and railroad bridges, particularly steel and prestressed concrete structures since they are most common in the northeast; and computer applications including bridge geometry, abutment design and composite beam design.

CE 638. Nondestructive Testing Methods in Civil Engineering. 3 credits, 3 contact hours.

Familiarizes the civil engineering student with nondestructive testing (NDT) techniques currently employed for evaluation and condition monitoring of civil structures and construction materials. Major emphasis in the application of NDT methodologies to steel, concrete, and timber as the construction material. Covers theories, principles, and testing methodologies associated with individual technologies from specific material point of view. Discusses advantages and limitations pertaining to the application of individual NDT technologies to construction materials.

CE 641. Engineering Properties of Soils. 3 credits, 3 contact hours.

Prerequisite: approved undergraduate course in soil mechanics within last five years. An in-depth study of physical and mechanical properties of soils. Topics include clay mineralogy, shear behavior and compressibility of fine and coarse grained soil; and in-situ measuring techniques such as vane shear, core penetration and pressure meter. Laboratory work includes consolidation test and triaxial test, with emphasis on analysis, interpretation and application of data to design problems.

CE 703. Concrete Durability. 3 credits, 3 contact hours.

Prerequisites: Undergraduate course in construction materials or reinforced concrete design, or permission of the instructor. This course will cover the design and maintenance of concrete structures and pavements from a material choice point of view. Students will learn how to design concrete mixtures, choose alternative and sustainable concrete materials, produce concrete specifications, protect concrete from long-term deterioration, and design solutions for repairing existing concrete. Students will learn about the mechanisms and chemistry and concrete deterioration. The following key topics will be covered: cement production, supplementary cementitious materials, mixture design and proportioning, concrete durability, dimensional stability, freeze-thaw attack, sulfate attack, corrosion, alkali-silica reaction, alternative cements, concrete specifications, and concrete construction.

CE 733. Design of Metal Structures. 3 credits, 3 contact hours.

Prerequisites: CE 636 (http://catalog.njit.edufile://search/%3fP=CE%20636/). Methods of design of metal structural systems. Topics include combined action of unsymmetrical sections, torsion of open and closed sections, buckling of columns and plates with various end conditions, and design of curved and boxed girders.

CE 734. Design of Tall Buildings and Space Structures. 3 credits, 3 contact hours.

Prerequisites: CE 636 (http://catalog.njit.edufile://search/%3fP=CE%20636/). Design of tall buildings and space structures emphasizing framing systems, and recent developments and current research related to the design of such structures.

CE 742. Geotechnology of Earthquake Engineering. 3 credits, 3 contact hours.

Prerequisite: CE 641 (http://catalog.njit.edufile://search/%3fP=CE%20641/). Explains the fundamentals of propagation of the earthquakes through soils to supporting structures and the use of computer programs in the solution of boundary value problems in soils. The first half is devoted to synthesis of earthquakes, mathematical formulation of the problem, measurement of applicable soil parameters, use of computer programs to solve 1-D wave propagation problems in soils with structures. The second half is devoted to soil liquefaction, soil-structure interaction, and design of machine foundations.

What are the Required Courses?

Code	Title	Credits
What are the Required Courses?		
Select four from the following:		12

CE 630	Matrix Analysis of Structures
CE 631	Advanced Reinforced Concrete Design
CE 632	Prestressed Concrete Design
CE 634	Structural Dynamics
CE 635	Fracture Mechanics of Engineering Materials
CE 637	Short Span Bridge Design
CE 638	Nondestructive Testing Methods in Civil Engineering
CE 641	Engineering Properties of Soils
CE 703	Concrete Durability
CE 733	Design of Metal Structures
CE 734	Design of Tall Buildings and Space Structures
CE 742	Geotechnology of Earthquake Engineering