POLYMERS AND PLASTICS

From the NJIT Department of Chemicals and Materials Engineering, the Graduate Certificate in Polymers prepares students to apply mathematical and scientific principles to the design, development and operational evaluation of synthesized macromolecular compounds and their application to specific engineering uses. This includes the development of industrial materials with tailored properties, the design of lightweight structural components, the use of liquid or solid polymers, and the analysis and control of polymerization processes.

Who would be suited to take this program?

This program is designed with Chemical Engineers in mind. Example industries where occupations may exist in this area may include: agriculture, automotive, fast-moving consumer goods (FMCG), consumer packaged goods (CMG), or chemical production management.

What will I learn?

- ***Polymerization-Principles and Practice* -** The structural and synthetic aspects of polymers and examines in detail a number of bench and industrial scale polymerization methods. In addition to kinetics and mechanisms of commercially important polymerization systems, students will examine reactive modification of synthetic and natural polymers and provides an introduction to applicable characterization methods.
- ***Mechanical Properties of Materials* -** Elements of elasticity and plasticity theory, deformation and fracture behavior of materials, the concept of dislocations and their interaction with other lattice defects, strengthening mechanisms in solids, and principles of failure analysis. Materials to be studied include metals, polymers, ceramics, glasses, and composites.
- ***Polymer Structures and Properties* -** Polymer structures and properties and their relationships from the molecular viewpoint to phenomenological descriptions. Topics include thermodynamics of a single molecule, dynamic theory and viscoelasticity of polymers, polymer solids and mechanical properties, rubbers, polymer blends and composites, biological polymers, and special applications.
- ***Design for Manufacturability* -** Methodologies used in the synthesis and analysis of product design to optimize manufacturability. The relationship of design to production processes, product material, material handling, quality costs, and CAD/CAM are presented. Emphasis is on both formed products and assembled products. Simulation and other design analysis tools are employed.
- ***Characterization of Materials* -** Introduction in chemical and materials engineering, and other engineering and science disciplines, to fundamentals and theory of different types of materials characterization tools. Methods and techniques necessary to understand and quantify diverse materials properties will be discussed. As important for many methods, basic principles of interaction of radiation and particle beams with matter will be studied. Topics include, but are not limited to: Diffraction methods; imaging via optical, scanning, transmission electron, scanning tunnelling, and field ion microscopy; microanalysis and spectroscopy, including energy dispersive, wavelength dispersive, Auger methods; secondary ion mass spectroscopy, X-ray photoelectron spectroscopy; materials preparation for analysis, including electron, ion growth, sputtering; thermal analysis: DTA, DSC; and depending on the availability and functionality of equipment, lab visits and demonstrations will be scheduled to the class to discuss some case studies.

Why study Polymers at NJIT?

One of the oldest departments of Newark College of Engineering, the Otto H. York Department of Chemical and Materials Engineering awarded its first three baccalaureate degrees in 1923. This program is interdisciplinary by nature, with learn outcomes crossing both the science and the engineering materials and chemicals realms, yet more lean toward the engineering side. Chemical engineers use chemistry, biology, physics and math in an integrated engineering mode in order to manufacture materials and products to modern society. They are involved with the full scale of processes, from the laboratory bench to the pilot plant and eventually to the manufacturing facility.

Into what industries might holders of this program find employment?

- Agriculture
- Automotive
- Fast-Moving Consumer Goods (FCMG)
- Consumer Packaged Goods (CMG)
- Chemical Production Management

Prerequisites

Applicants should have a bachelor's degree from an accredited institution with some undergraduate background in a related field (chemical engineering, manufacturing engineering, materials science, materials engineering, etc.).

Related Degree Programs

This graduate certificate may transition into a NJIT MS in Materials Science and Engineering: Materials Engineering option (https://catalog.njit.edu/graduate/newark-college-engineering/chemical-materials-engineering/materials-science-engineering-ms/).

What are the Required Courses?

Code	Title	Credits
Core Courses		**12**
Select four (4) of the following:		
CHE 781 (http://catalog.njit.edu/search/?P=CHE%20681)	Polymerization-Principles and Practice	
CHE 722 Additive Manufacturing & Appl		
MTSE 610 (http://catalog.njit.edu/search/?P=MTSE%20610)	Mechanical Properties of Materials	
CHE 782 (http://catalog.njit.edu/search/?P=CHE%20682)	Polymer Structures and Properties	
MNE 654 (http://catalog.njit.edu/search/?P=MNE%20654)	Design for Manufacturability	
BME 672 Biomaterials		
MTEN 613 (http://catalog.njit.edu/search/?P=MTEN%20613)	Characterization of Materials	