

New Jersey Institute of Technology
Advanced Manufacturing and Mechatronics Training Program

September 2019, nce@njit.edu

Call for Participation

The New Jersey Institute of Technology (NJIT) in collaboration with the United States Small Business Administration (US SBA) invites candidates for an Advanced Manufacturing and Mechatronics Training Program to be held on the NJIT Campus starting November 2019.

WHO SHOULD APPLY?

- (1) Individuals seeking or already working as technical/engineering staff in manufacturing-related fields
- (2) Individuals who work in technical areas (especially electrical and mechanical, engineering) and who are interested in branching into manufacturing careers
- (3) Current or prospective students of Engineering or Engineering Technology in community colleges or universities
 - Limited number of seats are also available to high school seniors

SCOPE

Twenty-two (22) meetings every Monday evening and Saturday morning, between November 2019 and February 2020 at the NJIT Makerspace (University Heights, Newark NJ)

CONTENT

Manufacturing skills in machinery, mechanical and electrical devices and mechatronics, operation, troubleshooting, repair, maintenance, standards, and safety.

CERTIFICATE OF COMPLETION

NJIT will provide an official Certificate of Completion to all participants who attended the training sessions and completed the program successfully.

COMMITMENT and COSTS

Participants are expected to attend at least 85% of the sessions and complete all assignments. The training is **FREE** to admitted participants (costs covered by the US SBA and NJIT)

Application: see enclosed APPLICATION FORM. Application review will start by October 16, 2019. Selected candidates will be notified via email and phone.

Advanced Manufacturing and Mechatronics Training Program

1 Training Module

1.1 Schedule

Every participant will be present and participate in twenty-two (22) training sessions, four (4) hours each, for a total of 88 hours during the training program.

In CYCLE I the participant takes the INTRODUCTORY TRAINING MODULE – eleven (11) 4-hour sessions – for a total of 44 hours.

In CYCLE II the participant takes the ADVANCED TRAINING MODULE – eleven (11) 4-hour sessions – for a total of 44 hours.

The university will offer two catch-up sessions for students who have missed one of the regular sessions during the term.

1.2 Training Modules

The program consists of two 11-week modules (cycles) (plus a make-up week at the end of each cycle). Each week will offer a 4-hour hands-on session conducted at the NJIT Makerspace.

Introductory Training Module: Fundamental Tools, Processes, and Materials

The Introductory Training Module will provide a foundation through integrated lectures and laboratories on each topic. The introduction includes an introductory mechatronics modules that will lay the foundation of mechatronics systems engineering skills from mechanical, electrical, and PLC programming perspectives.

Table 1. Introductory Training Module

Week	Session Topic	Summary
1	Introduction and Overview of the Session 1	Students are introduced to the instructional team, session coordinators and the support staff. Overview of the session and the topic breakdown is provided along with a tour of the Makerspace and NJIT campus. The session includes discussion and instructions on Safety.

2	Mechanical Hand Tools, Hardware, & Materials	Students are introduced to Mechanical Hand Tools including screw drivers, shears (i.e. scissors), hammers, saws, and wrenches. Each tool and how it interacts with respective hardware and materials will be demonstrated. The session includes discussion and instructions on Safety.
3		
4	Mechanical Measurement Tools	Students are introduced to Mechanical Measurement Tools including Tape Measures, scales (rulers), Squares, Thread Gauges, and Calipers. The session includes discussion and instructions on Safety.
5	Mechanical Power Tools	Students are introduced to Mechanical Power Tools including drills, drivers, and power saws. The respective hardware and materials will be noted for each power tool. The session includes discussion and instructions on Safety.
6	Mechanical Hand Finishing Tools	Students are introduced to Mechanical Hand Finishing Tools including Files, Sand Paper, Steel Wool, Nylon Mesh, Abrasive Pads, and Painting. The session includes discussion and instructions on Safety.
7	Mechanical Power Finishing Tools	Students are introduced to Mechanical Power Finishing Tools including power grinding, sanding, and buffing. Power tools (e.g. drill and dremel) utilizing attachments will be demonstrated as well as dedicated units. The session includes discussion and instructions on Safety.
8	Fundamentals of AC & DC Wiring Hardware, and Materials	Students are introduced to Fundamentals of AC & DC wiring. This includes typical wire gauge, plugs, batteries, junction boxes, breakers, and grounding. Section is focused on being able to identify different components and when each process should be used. The session includes discussion and instructions on Safety.
9	Electrical Hand & Measurement Tools	Students are introduced to Electrical Hand Tools including strippers, lineman pliers, and electrical testers. The session includes discussion and instructions on Safety.
10	Basic Mechatronics: PLC Anatomy, and Programming Basics	Students will learn about the anatomy of a PLC, analog and digital input/output (I/O) ports, and memory access. They will also learn about the basics of ladder-logic programming.

11	Basic Mechatronics: I/O Wiring and Programming, and Basic Math Implementation	Students will conduct hands-on experiments that include wiring up push buttons, switches, relays, and LED lights to I/O ports, and programming PLC to read from and write to the I/O ports. They will also learn about the implementation of basic mathematical functions and logic expressions.
12	Optional Make-Up	Students will have an opportunity to make up for any session they missed due to unavoidable circumstances.

Advanced Training Module: Fundamental of Mechanical & Electrical Assembly, Maintenance and Repair

The Advanced Training Module builds on the lessons of the Basic Training Module by integrating all of the Introductory Training Module topics in laboratories as well as a semester-long project.

Table 2. Advanced Training Module

Week	Session Topic	Summary
1	Basic Training Module Recap	Students will have an opportunity to revisit important learning outcomes covered in Basic Training Module. This lesson will serve as a refresher towards topics and activities that build upon items covered in the Basic Training Module. The session includes discussion and instructions on Safety.
2	Mechanical Assembly	Students are introduced to Mechanical Assembly including reading assembly instructions, organizing a Bill of Materials (BOM), preparing tools and hardware, mechanical assembly, and measurement post assembly. The session includes discussion and instructions on Safety.
3		
4	Electrical Assembly	Students are introduced to Electrical Assembly including reading assembly instructions, organizing a Bill of Materials (BOM), preparing tools and hardware, electrical assembly, and measurement post assembly. The session includes discussion and instructions on Safety.
5		
6	Basic Mechanical Equipment Troubleshooting	Students are introduced to Basic Mechanical Equipment Trouble Shooting. This includes identifying if an assembly is aligned and balanced, the correct hardware was used,

		identifying damaged material, identifying corrosion. The session includes discussion and instructions on Safety.
7	Basic Mechanical Equipment Maintenance & Repair	Students are introduced to Basic Mechanical Equipment Repair including removal of damaged hardware, cleaning, lubrication, and sanding and painting. The session includes discussion and instructions on Safety.
8	Basic Electrical Equipment Troubleshooting	Students are introduced to Basic Electrical Equipment Trouble Shooting. This includes identifying breaker and fuse conditions, battery conditions, and power switch/plug conditions. The session includes discussion and instructions on Safety.
9	Basic Electrical Equipment Maintenance & Repair	Students are introduced to Basic Electrical Equipment Maintenance and Repair. This includes how to reset a breaker and how to replace a fuse. The session includes discussion and instructions on Safety.
10	Advanced Mechatronics: Sensors and Actuators, Testing and Troubleshooting	Students will conduct hands-on experiments with industrial actuators (electrical motors, pneumatic devices, grippers, and relays) and proximity sensors (ultrasound, magnetic, and optical). They will also learn about testing and troubleshooting procedures.
11	Advanced Mechatronics: Real-World Industrial Applications	Students will conduct hands-on experiments with stepper and servo motors control. They will learn about real-world mechatronics applications including conveyors, robotics, and automated factory production lines.
12	Optional Make-Up	Students will have an opportunity to make up for any session they missed due to unavoidable circumstances.

1.3 Work and Training Environment – the NJIT Makerspace

The NJIT Makerspace (<https://www.njitmakerspace.com/>) is a rapid prototyping and collaboration facility where engineers, technologists, architects, designers, and scientists can create and test ideas, put theory into practice, and turn ideas into reality. This 21st-century prototyping, manufacturing, and collaborative space allows students, faculty, and industry partners, to build physical systems in a functional and inspirational environment.

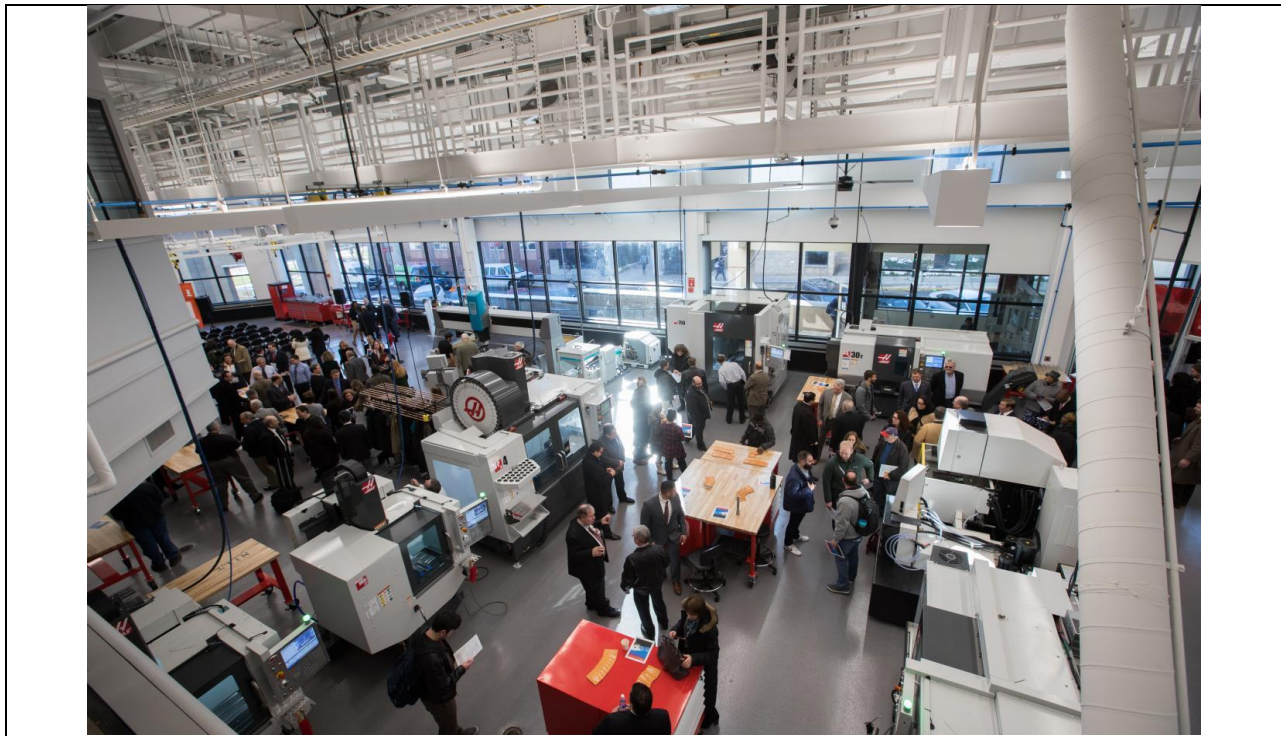


Figure 2. Representative image of the NJIT Makerspace.

"If you can dream it, you can make it at NJIT"

The largest of its kind facility in New Jersey and houses the industrial-grade tools and technologies that today's STEM students must master in order to become tomorrow's innovators and leaders. It provides them a venue where they can cooperate and work individually and in teams to test ideas, visualize, create prototypes, and apply complex technologies, machines, and materials used in state-of-the-art manufacturing. Through this process all participants gain real-world experience across an array of industries. Among other functions, the Makerspace offers equipment and devices for 3D printing, additive manufacturing, material cutting and shaping, metrology, visualization, computing, emulation, and simulation.