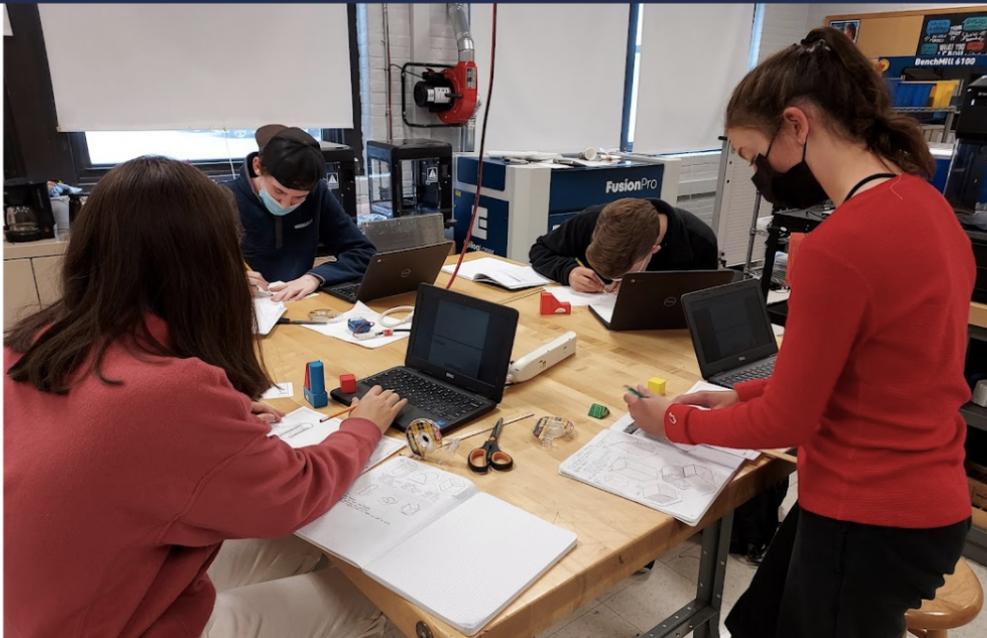




# Watertown High School

## **CAREER AND TECHNICAL EDUCATION**

### **ENGINEERING TECHNOLOGY**



# CTE @ WHS

## Engineering Technology

Engineering Technology is a MA Department of Elementary and Secondary Education (DESE) MGL Chapter 74 approved vocational program in which WHS partners with Project Lead the Way (PLTW) to offer this course of study.

### Engineering Technology I (Sophomores Only):

This consists of two Project Lead the Way (PLTW) units of study: Introduction to Engineering Design (IED) and Principles of Engineering (POE). The descriptions of these courses can be found below.

**Equivalent of 2 Full Year Courses: 12 credits**

### Engineering Technology II (Pathway Juniors only):

This course consists of three Project Lead the Way (PLTW) units of study: Digital Electronics (DE), Civil Engineering and Architecture (CEA) and Computer Integrated Manufacturing (CIM). The course description for DE as well as the descriptions for CEA and CIM can be found below.

**Equivalent of 3 Full Year Courses: 18 credits**

### Engineering Technology III:

This course consists of two Project Lead the Way (PLTW) units of study and 2 one-semester WHS courses: Engineering Design and Development (EDD), Environmental Sustainability (ES), Introduction to Robotics, and Entrepreneurship/Business. The descriptions for EDD and Introduction to Robotics can be found below. The description of ES can be found at [pltw.org](http://pltw.org).

**Equivalent of 2 Full Year and 2 Semester Courses: 18 credits**

### College Credit Available

Students completing a full year Project Lead the Way course with an end-of-course assessment (IED, POE, ES, CEA, CIM, or DE) are eligible to receive college credit (in some cases it must be purchased) for scoring a 6 or above on the End-of-Course (EoC) assessment combined with a grade of B or above in the course.

### Introduction to Engineering Design – IED - (L1-weighted course)

Students dig deep into the engineering design process, applying math, science, and engineering standards to hands-on projects. They work both individually and in teams to design solutions to a variety of problems using 3D modeling software and use an engineering notebook to document their work. This course is one of two possible prerequisites to specialized engineering courses. Through this course's practical real-world connections, students will see how science, mathematics, and engineering are part of their everyday life, how society and the environment is impacted

by the engineered world, and why it is important for every citizen to be technologically and scientifically literate.

NOTE: Students may purchase college credit for this course with an eligible score on the End of Course exam.

**Full Year: 6 credits**

### Principles of Engineering – POE - (L1-weighted course)

Through problems that engage and challenge, students explore a broad range of engineering topics, including mechanisms, the strength of structures and materials, and automation. Students develop skills in problem-solving, research and design while learning strategies for design process documentation, collaboration and presentation. Through this course's practical real-world connections, students will see how science, mathematics, and engineering are part of their everyday life, how society and the environment are impacted by the engineered world, and why it is important for every citizen to be technologically and scientifically literate.

NOTE: Students may purchase college credit for this course with an eligible score on the End of Course exam.

**Full Year: 6 credits**

### Digital Electronics – DE – (Honors-weighted course)

(Prerequisite: Successful completion of IED or POE)

From smartphones to appliances, digital circuits are all around us. This course provides a foundation for students who are interested in electrical engineering, electronics or circuit design. Students study topics such as combinational and sequential logic and are exposed to circuit design tools used in industry, including logic gates, integrated circuits and programmable logic devices.

NOTE: Students may purchase college credit for this course with an eligible score on the End of Course exam.

**Full Year: 6 credits**

### Civil Engineering and Architecture – CEA – (Honors-weighted course)

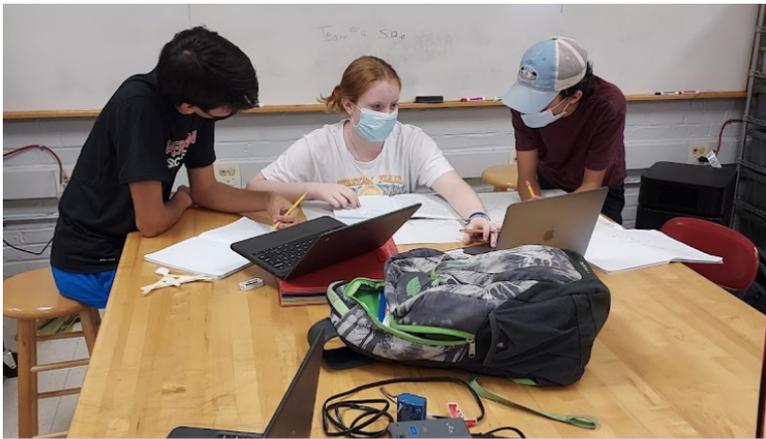
(Prerequisite: Successful completion of IED AND either of POE OR DE)

In Civil Engineering and Architecture (CEA) students are introduced to important aspects of building and site design and development. They apply math, science, and standard engineering practices to design both residential and commercial projects and document their work using 3D architectural design software. Utilizing the activity-project-problem-based (APB) teaching and learning pedagogy, students will progress from completing structured activities to solving open-ended projects and problems that require them to develop planning, documentation, communication, and other professional skills.

Through both individual and collaborative team activities, projects, and problems, students will solve problems as they practice common design and development protocols such as project management and peer review. Students will develop skill in engineering calculations, technical representation and documentation of design solutions according to accepted technical standards, and use of current 3D architectural design and modeling software to represent and communicate solutions.

NOTE: Students may purchase college credit for this course with an eligible score on the End of Course exam.

**Full Year: 6 credits**



### Computer Integrated Manufacturing – CIM – (Honors-weighted course)

(Prerequisite: Successful completion of IED AND either of POE OR DE)

Manufactured items are part of everyday life, yet few people understand the excitement and innovation that is used to transform ideas into products. This course provides an opportunity for students to recognize many of the exciting career opportunities in the manufacturing industry. Computer Integrated Manufacturing deepens the skills and knowledge of an engineering student within the context of efficiently creating the products all around us. Students build upon their Computer Aided Design (CAD) experience through the use of Computer Aided Manufacturing (CAM) software. CAM transforms a digital design into a program that a Computer Numerical Controlled (CNC) mill uses to transform a block of raw material into a product designed by a student. Students learn and apply concepts related to integrating robotic systems such as Automated Guided Vehicles (AGV) and robotic arms into manufacturing systems.

Throughout the course students learn about manufacturing processes and systems. This course culminates with a capstone project where students design, build, program, and present a manufacturing system model capable of creating a product. NOTE: Students may purchase college credit for this course with an eligible score on the End of Course exam.

**Full Year: 6 credits**

### Environmental Sustainability - ES - (Honors-weighted course) - Counts as a lab Science course.

(Prerequisite: Successful completion of IED and Instructor Recommendation)

Environmental Sustainability (ES) is a high school-level specialization course in PLTW Engineering. In ES, students investigate and design solutions to solve real-world challenges related to clean drinking water, a stable food supply, and renewable energy. Students are introduced to environmental issues and use the engineering design process to research and design potential solutions. Utilizing the activity-, project-, problem-based (APB) teaching and learning pedagogy, students transition from completing structured activities to solving open-ended projects and problems that require them to develop planning, documentation, communication, and other professional skills.

Through both individual and collaborative team activities, projects, and problems, students problem solve as they practice common design and scientific protocols such as project management, lab techniques, and peer review. Students develop skills in designing experiments, conducting research, executing

technical skills, documenting design solutions according to accepted technical standards, and creating presentations to communicate solutions.

**Full Year: 6 credits**

### Engineering Design and Development - EDD - (AP weighted course)

(Prerequisite: Successful completion of IED AND either of POE OR DE)

EDD is the capstone course in the PLTW high school engineering program. It is an open-ended engineering research course in which students work in teams to design and develop an original solution to a well-defined and justified open-ended problem by applying an engineering design process. Students will perform research to select, define, and justify a problem. After carefully defining the design requirements and creating multiple solution approaches, teams of students select an approach, create, and test their solution prototype. Student teams will present and defend their original solution to an outside panel. While progressing through the engineering design process, students will work closely with experts and will continually hone their organizational, communication and interpersonal skills, their creative and problem-solving abilities, and their understanding of the design process. NOTE: Students may purchase college credit for this course with an eligible score on the End of Course exam.

**Full Year: 6 credits**

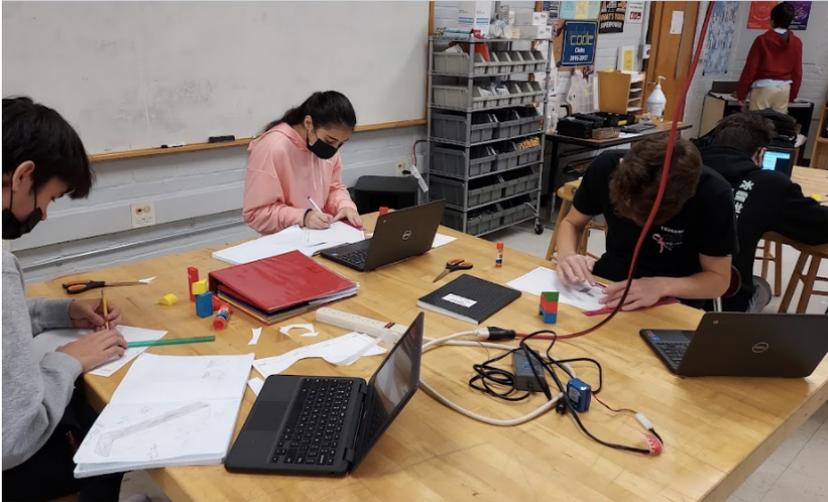
### Introduction to Robotics - (L1-weighted course)

Students will learn the basics of the Python programming language in or to control the movements of a bipedal robot. The robot's brain will be powered by a Raspberry Pi microcontroller, a miniature computer commonly used by aspiring inventors. A variety of sensors will be connected to the Raspberry Pi allowing the robot to interact with the world. Just for fun, once the robots have been born we will make them fight. Time permitting; students will create their own interactive robotic machines to solve specialized problems.

**Semester Course: 3 credits**



## Potential Careers



### College Credit

Students completing a full year Project Lead the Way course with an end-of-course assessment (IED, POE, CIM, or DE) are eligible to receive college credit (in some cases it must be purchased) for scoring a 6 or above on the End-of-Course (EoC) assessment combined with a grade of B or above in the course.

**CNC Machinist  
Quality Control Technician  
Manufacturing Technician  
Field Service Technician  
Engineering Technician  
Test Technician  
R&D Technician  
Electronic Assembler  
Mechanical Assembler  
Engineer (4-Yr College)**

## SAMPLE STUDENT SCHEDULE

### Grade 10

Course	FY/ Sem	Credits
ELA	FY	6
Math	FY	6
Social Studies	FY	6
Science	FY	6
Wellness	Sem	3
Elective	Sem	3
Vocational Year 1	FY X2	12

### Grade 11

Course	FY/ Sem	Credits
ELA	FY	6
Math	FY	6
Social Studies	FY	6
Science/ Elective*	Sem	3
Wellness	Sem	3
Vocational Year 2	FY X3	18

### Grade 12

Course	FY/ Sem	Credits
ELA	FY	6
Math	FY	6
Wellness	Sem	3
Elective	Sem	3
Science/ Elective*	FY/ 2 Sem	6
Vocational Year 3	FY X3	18

\*pathway may include a Science course