Syracuse City School District
Career and Technical Education Program
Mechanical Technology Pathway
Summary Overview

Program Overview

The PTECH Mechanical Technology program provides students with the opportunity to learn the fundamentals of mechanical technology toward the goal of earning college credits and an Associate's degree in Mechanical Technology from Onondaga Community College. Students will learn fundamental concepts about mechanical systems and electrical circuits, and the operation of mechanical and electronic equipment. Students will gain hands-on experience in using measuring tools, simple machines, machine tools, and computer software to analyze and design mechanical systems. Students will explore and utilize the latest technological advancements in computer drafting and computer-aided design. Students will construct, test, analyze, trouble-shoot and repair simple and complex systems using real world tools and technologies. Student will learn techniques for data collection and analysis, and the process of failure analysis. Students will also learn about the importance of ethical conduct and will develop the critical and analytical thinking, troubleshooting and problem-solving skills necessary for success in the mechanical technology field. Students will explore the different career pathways available within the field of mechanical technology and have the opportunity to apply and enhance their skills through multiple work-based experiences.

Course Calendar

100 9th Grade			
1	**2**	**3**	**4**
• Introduction to the Program, the School, and the Future • Introduction to Technology • The Design Process • Design and Modeling • Work-Based Learning: Career Coaching, Job Shadowing	• Measurement Tools and Techniques • Manufacturing Technology • Math and Science Connections • Work-Based Learning: Career Coaching, Job Shadowing	• Materials and Fabrications • Mechanical Technology • Electrical Technology • Electronics • Work-Based Learning: Career Coaching, Job Shadowing	• The Technology Team • Final Class Project • Work-Based Learning: Career Coaching, Job Shadowing • Course Wrap-Up and Evaluation
200 10th Grade			
1	**2**	**3**	**4**
• Introduction to Course, Classroom Practices, and Expectations: Being Successful • Roles and Responsibilities of Technicians • Technology Careers • Use of Practical Measuring Tools • Mechanical and Electrical Technology • Fundamentals of Electricity • Work-Based Learning: Career Coaching, Job Shadowing	• Electrical Circuit Components • Input/Output Devices • Mechanical Drive Systems: Key Fasteners, Power Transmission, Spur Gears and Multiple Shaft Drives • Work-Based Learning: Career Coaching, Job Shadowing	• Mechanical Drive Systems: V-Belt and Chain Drives • Introduction to Technical Drawings • Introduction to CAD (Computer Aided Drawing) • Work-Based Learning: Career Coaching, Job Shadowing	• Introduction to Problem Solving Failure Analysis • Simple Machines • Computer Programs • Collecting and Analyzing Data, Statistics • Ethics • Work-Based Learning: Career Coaching, Job Shadowing • Final Project Presentations • Course Wrap-Up and Evaluation

<table>
<tr><th colspan="2">300
11th Grade</th></tr>
<tr><th>1 and 2</th><th>3 and 4</th></tr>
<tr><td>Classroom Practices: Being Successful
Personal and Professional Characteristics in Mechanical Technology
Workplace Safety: OSHA 10 Certification
MET 161: Engineering Drawing
Work-Based Learning: Career Coaching, Job Shadowing</td><td>MET 151 Machine Tools 1
Shop Safety, Reading Drawings, and Hand Tools
Dimensional Measurement
Materials and Layout
Introduction to Machine Tools
Sawing and Drilling
Turning and Milling
Grinding and Right Triangle Trigonometry
Work-Based Learning: Career Coaching, Job Shadowing</td></tr>
<tr><th colspan="2">400
12th Grade</th></tr>
<tr><th>1 and 2</th><th>3 and 4</th></tr>
<tr><td>Classroom Practices: Being Successful
Personal and Professional Characteristics in Mechanical Technology
Workplace Safety: OSHA 10 Certification
Senior Project
Review of MET 151: Machine Tools 1
MET 152: Machine Tools 2
Work-Based Learning: Career Coaching, Job Shadowing</td><td>MET 152: Machine Tools 2 (Continued)
Work-Based Learning: Job Shadowing, Internship</td></tr>
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Syracuse City School District
Career and Technical Education Program
Course Syllabus
Level 100: Engineering Design

Program Overview

The PTECH Mechanical Technology program provides students with the opportunity to learn the fundamentals of mechanical technology toward the goal of earning college credits and an Associate's degree in Mechanical Technology from Onondaga Community College. Students will learn fundamental concepts about mechanical systems and electrical circuits, and the operation of mechanical and electronic equipment. Students will gain hands-on experience in using measuring tools, simple machines, machine tools, and computer software to analyze and design mechanical systems. Students will explore and utilize the latest technological advancements in computer drafting and computer-aided design. Students will construct, test, analyze, trouble-shoot and repair simple and complex systems using real world tools and technologies. Student will learn techniques for data collection and analysis, and the process of failure analysis. Students will also learn about the importance of ethical conduct and will develop the critical and analytical thinking, troubleshooting and problem-solving skills necessary for success in the mechanical technology field. Students will explore the different career pathways available within the field of mechanical technology and have the opportunity to apply and enhance their skills through multiple work-based experiences.

Course Description

This course will provide an overview of various aspects of the mechanical and electrical technology professions. Students will explore different careers and experience solving problems by applying a design development process. Students will develop, analyze, and test product solutions and models as well as communicate the features of those models. Students will learn more about the pathways to selected technology careers and begin to develop foundational skills in professional and ethical responsibilities. Students will learn fundamental math and science concepts practical to technology, the function of electrical components and the methods used to design consumer products, such as AutoCAD and TinkerCad. Through various work-based experiences, they will learn about the education requirements, roles and responsibilities, regulatory agencies, and work settings for various career pathways within the technology field. Students will work collaboratively as part of a team to create, problem-solve and present projects that address authentic issues in the community and will learn and apply standard technology nomenclature within the context of their projects. Professionalism, critical thinking and problem-solving skills, and accurate and appropriate oral and written communication will be emphasized.

Work-Based Learning

Students will connect with working mechanical and electrical technology professionals through field trips, job shadowing and Career Coaching, leading to opportunities for direct job training and real-world experiences. Students will create and maintain a portfolio of their experiences to document the development of their skills, including a professional resume and employability profile.

Additional Learning Opportunities

- **Micro-credentials:** Students may pursue learning experiences and credentials depending on the requirements of the projects that they are involved in. Some examples for this pathway include, but are not limited to:
  - OSHA-10 General Industry Safety Certification
  - OSHA-30 General Industry Safety Training
  - Digital Multimeter Certification
  - CompTIA ITF+ Certification: IT Fundamentals
  - CompTIA Tech+ Certification
  - Other relevant certifications as they become available through industry collaborations, teacher certifications and student interest.
- **Summer Bridge Enrichment:** Students will have the opportunity to participate in cross-curricular Summer Bridge programs to enhance and enrich their skills. Students will explore and create solutions that address authentic needs in the school and wider community with the involvement of local industry professionals. Students will build on skills learned during the school year to work collaboratively with students from other pathways and programs.

Pre-Requisites

N/A

Course Objectives

By the end of this course, students will:

- identify and understand the major disciplines in the technology field and associated pathways to becoming educated.
- apply math and science concepts to the technology profession.
- learn basic design processes for application to assigned projects.
- identify ethical and professional roles and responsibilities in the technology profession.
- learn and apply basic skills in technical drawing and design, CAD, and use of practical technology tools.
- understand the concepts of materials and fabrication.
- understand motion and simple machines.
- learn basic concepts of mechanical and electrical technology.
- apply teamwork, communication skills, and sound research practices to assigned projects.

Integrated Academics

N/A

Equipment and Supplies

- **School will provide:** Computer hardware and software, all necessary instruments and equipment
- **Student will provide:** Necessary school supplies

Textbook

TBD

Grading

Quarters 1 and 2		**Quarters 3 and 4**	
• Homework, Quizzes	25%	• Homework, Quizzes, Tests	20%
• Tests, Reports, Projects	25%	• Technical Writing, Projects	20%
• Technical Drawings	25%	• Data Analysis Application	20%
• Professionalism	25%	• Research Papers	20%
		• Professionalism	20%

Additional Course Policies

- Meet all deadlines and be on time. Meeting deadlines and being on time are a major part of being a professional.
- Produce your best work, including being prepared for presentations.
- Participate in class, including contributing to discussions and critiquing your own and others' work, as well as diligently working on your own projects.
- Seek help when needed.
- Be attentive, ask questions if you do not understand something, and offer your opinions.
- Use provided software platforms for preparing and sharing all work.
- Give credit and use proper citations for all research and project ideas.

Course Calendar

100 9th Grade			
1	**2**	**3**	**4**
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Syracuse City School District
Career and Technical Education Program
Scope and Sequence
Level 100: Engineering Design

Time Frame Unit of Study	Key Questions	Key Learning Targets (Students will know and be able to)	Assessment Evidence of Learning	CCTC Standards	NYS Standards
Weeks 1-2 **Introduction to the Program, the School, and the Future**	• What is the ultimate goal of this CTE program? • What are the expectations for the CTE Mechanical and Electrical Technology classroom and lab? • How will students be successful in school and in the CTE program? • How can students use technology appropriately and effectively? • How will students keep themselves and others safe? • What is the district's Code of Conduct? • What supports are available to students in the classroom, lab, school, and district? • What do respect and leadership mean?	• Explain the goals and expectations of the 4-year high school Mechanical and Electrical Technology program. • Summarize classroom procedures and expectations. • Explain and follow classroom rules and procedures. • State and apply safety rules and procedures for the class and school. • Describe the Code of Conduct and where to reference it. • Identify classroom, lab, school, and district supports and resources. • Demonstrate classroom respect and leadership.	• Community Building Activities • Safety Quiz • Compliance with Procedures • Posters with Presentations: Respect and Leadership	**Career Ready Practices** CRP 1,2,4,7,10,11 **Cluster Standards** ST 4 **Pathway Standards** ST-ET 2	**ELA** 9-10R 1,2,4 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6 **Literacy** 9-10RST 1,2,4 9-10WHST 2,5,6,7 **Math** **Science**
Weeks 3-4 **Introduction to Technology**	• What is the definition of technology? • What are the connections between science, technology, and mathematics? • What are some early examples of technology and great technology achievements of the past century? • How do major technology activities compare?	• Define technology. • Describe how technology has affected the world in the past and the present. • Identify several early examples of technology. • Evaluate great technology achievements of the past century. • Compare and contrast the major technology activities.	• Technology Terms Quiz • Research Paper: Technology Achievements of the Past • Research Assignment: Benefits of the Technology Profession • Student-Developed Questions for Guest Speaker	**Career Ready Practices** CRP 1,2,4,7,8,10,11 **Cluster Standards** ST 4 **Pathway Standards** ST-ET 2	**ELA** 9-10R 1,2,4 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6 **Literacy** 9-10RST 1,2,4 9-10WHST 2,5,6,7 **Math** **Science** HS-ETS 1-2, 1-3
Weeks 5-7 **The Design Process**	• What is meant by the technology design process? • What are the common design process steps? • What are the constraints to technology design? • How can old products or buildings be updated to include new technology ideas and achievements?	• Outline and describe the design process. • List steps in common design process. • Identify technology problems and opportunities. • Explain design constraints. • Identify types of research involved in developing a project.	• Design Project Presentations • Quiz, Test • PBL Project	**Career Ready Practices** CRP 1,2,4,7,8,11,12 **Cluster Standards** ST 1,2,6 **Pathway Standards** ST-ET 2,5	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6 **Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7 **Math** G SRT 5,6,8 G-MG-1,3 G-GMD.4 N-Q.1 **Science**

Time Frame Unit of Study	Key Questions	Key Learning Targets (Students will know and be able to)	Assessment Evidence of Learning	CCTC Standards	NYS Standards
					HS-ETS 1-2, 1-3
Weeks 8-10 **Design and Modeling**	• Why is sketching important? • What are the different types of lines used in technical drawings? • How are the most common views, perspectives and drawing types of manufactured objects used today? • What are the types and uses of theoretical models? • What are the methods of generating three-dimensional models? • What are the purposes and features of a prototype?	• Identify the sketching skills and techniques used by technicians. • Recognize the different types of lines in technical drawings. • Examine the methods of generating three-dimensional models. • Generate and describe three dimensional views. • Compare and explain the types of theoretical models and their uses. • Explain prototyping and rapid prototyping.	• Design Project with Sketches, Drawings, and Prototyping • Quizzes • Project Completion and Assessment	**Career Ready Practices** CRP 1,2,4,8	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-ET 1,3,4 ST-SM 4	**Math** G SRT 5,6,8 G-GMD.4 N-Q.1 S-IC.4
					Science HS-ETS 1-2,1-3,1-4
Week 10 **Work-Based Learning:** **Career Coaching, Job Shadowing**	• What can be learned from mechanical and electrical technology professionals?	• Participate in Career Coaching process. • Participate in Job Shadowing process with local mechanical and electrical technology professionals.	• Career Coaching Self-Assessment • Job Shadow Reflection • Professional Portfolio	**Career Ready Practices** CRP 1,2,4,7,8,10,11,12	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards MN 1,4 ST 4,5,6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards MN-PRO 4 ST-ET 1,4 ST-SM 1,2,4	**Math** **Science**
Weeks 11-12 **Measurement Tools and Techniques**	• What are standard measuring tools? • How are measuring devices used? • What is tolerance and how is it checked? • What is scaling?	• Identify standard measuring tools. • Demonstrate correct use of tools to measure components. • Define geometric tolerance. • Analyze dimensions from a drawing and check components. • Determine where to locate drawing scale from a print.	• Quiz: Application of Measurement Terminology • Drawing Dimensions Assessment • Performance Assessment: Use of Measuring Tools	**Career Ready Practices** CRP 1,2,4,7,8,11	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 4,6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-SM 1,4	**Math** G-MG.1,3 N-Q.3 S-IC.4
					Science
Weeks 13-16 **Manufacturing Technology**	• What is prototyping? • What is quality control? • What is computer-aided manufacturing? • Why is packaging important to a manufacturer?	• Explain the benefits of prototyping. • Identify four types of manufacturing systems and explain the benefits of each. • Explain how quality control in manufacturing has evolved.	• Terminology Quiz • Packaging Challenge • Quality Analysis Exercise	**Career Ready Practices** CRP 1,2,4,8,11,12	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards MN 6	**Literacy** 9-10RST 1,2,4,7,8,9

Time Frame Unit of Study	Key Questions	Key Learning Targets (Students will know and be able to)	Assessment Evidence of Learning	CCTC Standards	NYS Standards
		• Compare and contrast the roles of computer-aided and computer-integrated manufacturing. • Analyze the role of packaging in the manufacturing process.		ST 1,6 **Pathway Standards** MN-PPD 1,3,4,5	9-10WHST 2,5,6,7 **Math** S-IC.1,4,6 **Science** HS-ETS 1-4
Weeks 17-19 **Math and Science Connections**	• Why are math and science important in technology tasks? • How do technicians use mathematics to manage costs? • What is the impact of nature on technology design? • What types of energy should technicians be able to evaluate?	• Explain why math and science are important to the daily tasks of technicians in all disciplines. • Describe how probability and statistics affect the choices applied to technology designs. • List applications of geometry and trigonometry in technology. • Identify three main physics topics of interest to technicians.	• Written Summary • Discovery Project	**Career Ready Practices** CRP 1,2,4,8,11 **Cluster Standards** ST 4 **Pathway Standards** ST-SM 1,4	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6 **Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7 **Math** A-CED.4 S-ID.4 **Science** HS-ESS 2-1 HS-PS 3-1
Week 20 **Work-Based Learning:** **Career Coaching, Job Shadowing**	• What can be learned from mechanical and electrical technology professionals?	• Participate in Career Coaching process. • Participate in Job Shadowing process with local mechanical and electrical technology professionals.	• Career Coaching Self-Assessment • Job Shadow Reflection • Professional Portfolio	**Career Ready Practices** CRP 1,2,4,7,8,10,11,12 **Cluster Standards** MN 1,4 ST 4,5,6 **Pathway Standards** MN-PRO 4 ST-ET 1,4 ST-SM 1,2,4	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6 **Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7 **Math** **Science**
Weeks 20-22 **Materials and Fabrications**	• What are the characteristics and classifications of natural and synthetic materials? • How do technicians choose parts for a project? • How are the strengths of materials established? • How does the development of new materials affect the techniques used to fabricate various objects and structures?	• Identify the characteristics used to classify and group both natural and synthetic materials. • Evaluate how technicians choose parts for a project. • Describe how the strength of a material can be established. • Compare and contrast manufacturing and construction. • Analyze how fabrication techniques affect the design process.	• Assessment of Material Types Using Various Testing Procedures • Terminology Exam • Team Competition PBL Project	**Career Ready Practices** CRP 1,2,4,8,11,12 **Cluster Standards** MN 6 ST 1,2,3 **Pathway Standards** ST-ET 1,2	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6 **Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7 **Math** A-CED.4 N-Q.1 **Science** HS-ETS 1-2, 1-3 HS-PS 2-6
Weeks 23-25 **Mechanical**	• What are Newton's laws of motion?	• Summarize Newton's three laws of motion.	• Task Analysis: Technology Steps	**Career Ready Practices** CRP 1,2,4,8,11	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7

Time Frame Unit of Study	Key Questions	Key Learning Targets (Students will know and be able to)	Assessment Evidence of Learning	CCTC Standards	NYS Standards
Technology	• What are the laws of thermodynamics? • What is the difference between hydraulics and pneumatics? • What is a simple machine? • What are the six simple machines? • What are the different types of motion?	• Evaluate the laws of thermodynamics. • Compare and contrast hydraulics and pneumatics. • Describe and explain the six simple machines. • Identify five different types of motion. • Analyze the purpose of basic mechanisms.	Needed for the Development of a Selected Product • Research Report: Product Using Simple Machines • Mechanical Terminology Quiz		9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards MN 6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards MN-PPD 1,3,5	**Math**
					Science HS-PS 2-1, 3-1, 3-2
Weeks 26-27 **Electrical Technology**	• How is electricity measured and what terms are used in measuring electricity? • How is electricity generated? • What is the difference between direct and alternating current?	• Identify at least four measurements (and their units of measure) that are critical to electrical and electronics technicians. • Describe several ways energy is used to create electricity. • Compare direct current and alternating current.	• Simple Generator Construction • Electrical Terminology Quiz • Performance Test: Calculating and Measuring Volts, Ohms, Amps	**Career Ready Practices** CRP 1,2,4,6,8,11,12	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 2,5	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-ET 5 ST-SM 1,2,3,4	**Math** A-CED.2,4
					Science HS-PS 3-1,3-2,3-6
Weeks 28-32 **Electronics**	• What is electronics technology and what are the educational requirements for electronics technicians? • What is Ohms Law? • What type of equipment and components are used in electronics? • What is a capacitor? • What is a resistor?	• Explain electronics technology, educational requirements. • Explain Ohm's Law. • Analyze the effect of digital electronics and integrated circuits. • Describe the relationship between electrical potential (voltage), rate of flow (current), and resistance in an electric circuit, according to Ohm's law.	• Task Analysis: Technology Steps Needed for the Development of a Selected Product • Terminology Quiz • Reading Schematic Drawings Assessment	**Career Ready Practices** CRP 1,2,4,8,11	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-ET 3 ST-SM 1,4	**Math** A-CED.2,4
					Science HS-PS 3-6
Week 30 **Work-Based Learning:** **Career Coaching, Job Shadowing**	• What can be learned from mechanical and electrical technology professionals?	• Participate in Career Coaching process. • Participate in Job Shadowing process with local mechanical and electrical technology professionals.	• Career Coaching Self-Assessment • Job Shadow Reflection • Professional Portfolio	**Career Ready Practices** CRP 1,2,4,7,8,10,11,12	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards MN 1,4 ST 4,5,6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards MN-PRO 4 ST-ET 1,4 ST-SM 1,2,4	**Math**
					Science
Weeks 33-35 **The Technology Team**	• What other professions are involved with technicians? • What are the ways in which	• Identify the professionals and team members who work with technicians. • Describe communication skills	• Research and Presentations: Professional Qualities	**Career Ready Practices** CRP 1,2,4,7,11	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6

Time Frame Unit of Study	Key Questions	Key Learning Targets (Students will know and be able to)	Assessment Evidence of Learning	CCTC Standards	NYS Standards
	technicians communicate? • Why is communication an integral part of technology?	technicians must develop to work successfully with others. • Examine the additional safety, information technology, cultural, and business skills that are important to the technician's professional life. • Analyze the need to diversify the technology workforce.	Used in the Field of Technology		9-10L 1,2,3,4,5,6
				Cluster Standards ST 5	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-ET 2,3	**Math**
					Science HS-ETS 1-2, 1-3
Weeks 36-39 **Final Class Project**	• How can I apply what I know in a final project?	• Apply all aspects of the design process to a final project. • Evaluate peer projects and provide growth-producing feedback.	• Final Project with Peer and Instructor Rubrics	**Career Ready Practices** CRP 1,2,4,8,11,12	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 2,3,6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-ET 1,2,4,5	**Math** G-SRT.5,6,8 5G-MG.1,3 G-GMD.4 N-Q.1 S-IC.1,4,6
					Science HS-ETS 1-2, 1-3
Week 39 **Work-Based Learning:** **Career Coaching, Job Shadowing**	• What can be learned from mechanical and electrical technology professionals?	• Participate in Career Coaching process. • Participate in Job Shadowing process with local mechanical and electrical technology professionals.	• Career Coaching Self-Assessment • Job Shadow Reflection • Professional Portfolio	**Career Ready Practices** CRP 1,2,4,7,8,10,11,12	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards MN 1,4 ST 4,5,6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards MN-PRO 4 ST-ET 1,4 ST-SM 1,2,4	**Math** **Science**
Week 40 **Course Wrap-Up and Evaluation**	• How can I apply what I know in a final project? • What have I learned?	• Apply technology knowledge and principles to a topic as a final project. • Review for final exam.	• Final Exam	**Career Ready Practices** CRP 1,2,4,6,7,8,11,12	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST1,2,3,6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-ET 1,2,3	**Math**
					Science

Syracuse City School District
Career and Technical Education Program
Course Syllabus
Level 200: Engineering Design and Development

Program Overview

The PTECH Mechanical Technology program provides students with the opportunity to learn the fundamentals of mechanical technology toward the goal of earning college credits and an Associate's degree in Mechanical Technology from Onondaga Community College. Students will learn fundamental concepts about mechanical systems and electrical circuits, and the operation of mechanical and electronic equipment. Students will gain hands-on experience in using measuring tools, simple machines, machine tools, and computer software to analyze and design mechanical systems. Students will explore and utilize the latest technological advancements in computer drafting and computer-aided design. Students will construct, test, analyze, trouble-shoot and repair simple and complex systems using real world tools and technologies. Student will learn techniques for data collection and analysis, and the process of failure analysis. Students will also learn about the importance of ethical conduct and will develop the critical and analytical thinking, troubleshooting and problem-solving skills necessary for success in the mechanical technology field. Students will explore the different career pathways available within the field of mechanical technology and have the opportunity to apply and enhance their skills through multiple work-based experiences.

Course Description

In this course, students will continue to work on the technology concepts, practices and projects introduced in Level 100: Engineering Design and will explore various aspects of the technology profession as they apply engineering research principles to design and construct solutions to engineering problems. Students will develop and test solutions using computer simulations, models, and working prototypes as part of the design solution. Students will gain additional knowledge about potential career pathways to selected technology roles. They will work to further develop skills in professional and ethical responsibilities and behaviors. Through their enrollment in ENS 150/MET 150: Introduction to Engineering at Onondaga Community College, students will be introduced to more advanced skills in technical drawing, the use of practical technology tools, technology design, CAD, data collection and analysis methods. Students will learn and apply concepts and skills of the fundamentals of electricity, electrical circuits and input/output devices, and drive systems. Through various work-based experiences, students will continue to study education requirements, roles and responsibilities, regulatory agencies, and work settings for various career pathways within the technology field. Students will work collaboratively as part of a team to create, problem-solve and present projects that address authentic issues in the community and will learn and apply standard technology nomenclature within the context of their projects. Professionalism, critical thinking and problem-solving skills, and accurate and appropriate oral and written communication will continue to be emphasized and developed.

Work-Based Learning

Students will connect with working mechanical and electrical technology professionals through field trips, job shadowing and Career Coaching, leading to opportunities for direct job training and real-world experiences. Students will create and maintain a portfolio of their experiences to document the development of their skills, including a professional resume and employability profile.

Additional Learning Opportunities

- **Micro-credentials:** Students may pursue learning experiences and credentials depending on the requirements of the projects that they are involved in. Some examples for this pathway include, but are not limited to:
    - OSHA-10 General Industry Safety Certification
    - OSHA-30 General Industry Safety Training
    - Digital Multimeter Certification
    - CompTIA ITF+ Certification: IT Fundamentals
    - CompTIA Tech+ Certification
    - Other relevant certifications as they become available through industry collaborations, teacher certifications and student interest.
- **Summer Bridge Enrichment:** Students will have the opportunity to participate in cross-curricular Summer Bridge programs to enhance and enrich their skills. Students will explore and create solutions that address authentic needs in the school and wider community with the involvement of local industry professionals. Students will build on skills learned during the school year to work collaboratively with students from other pathways and programs.

Pre-Requisites

Level 100: Engineering Design

Course Objectives

By the end of the course students will:

- identify the major disciplines in the technology field and associated pathways to becoming educated.
- identify ethical and professional roles and responsibilities of the technology profession.
- apply teamwork, communication skills research practices to assigned projects.
- learn and apply electrical and drive system concepts.
- learn and apply basic skills in technical drawing and design, CAD, and use of practical technology tools.
- learn and apply data collection and elementary statistics to a variety of designs in both student-produced and industry-produced projects.

Integrated Academics

N/A

Concurrent Enrollment College Credit

Upon successful completion of Level 200: Engineering Design and Development, will earn 3 college credits for ENS150/MET 150: Introduction to Engineering from Onondaga Community College.

Equipment and Supplies

- **School will provide:** Computer hardware and software, all necessary instruments and equipment
- **Student will provide:** Necessary school supplies

Textbook

Moaveni, S. (2019). *Fundamentals of Engineering: An Introduction to Engineering, 6th Edition.* Boston, MA: Cengage.

Grading

Quarters 1 and 2		**Quarters 3 and 4**	
• Homework, Quizzes	25%	• Homework, Quizzes, Tests	20%
• Tests, Reports, Projects	25%	• Technical Writing, Projects	20%
• Technical Drawings	25%	• Data Analysis Application	20%
• Professionalism	25%	• Research Papers	20%
		• Professionalism	20%

Additional Course Policies

- Meet all deadlines and be on time. Meeting deadlines and being on time are a major part of being a professional.
- Produce your best work, including being prepared for presentations.
- Participate in class, including contributing to discussions and critiquing your own and others' work, as well as diligently working on your own projects.
- Seek help when needed.
- Be attentive, ask questions if you do not understand something, and offer your opinions.
- Use provided software platforms for preparing and sharing all work.
- Give credit and use proper citations for all research and project ideas.

Course Calendar

200 10th Grade			
1	**2**	**3**	**4**
• Introduction to Course, Classroom Practices, and Expectations: Being Successful • Roles and Responsibilities of Technicians • Technology Careers • Use of Practical Measuring Tools • Mechanical and Electrical Technology • Fundamentals of Electricity • Work-Based Learning: Career Coaching, Job Shadowing	• Electrical Circuit Components • Input/Output Devices • Mechanical Drive Systems: Key Fasteners, Power Transmission, Spur Gears and Multiple Shaft Drives • Work-Based Learning: Career Coaching, Job Shadowing	• Mechanical Drive Systems: V-Belt and Chain Drives • Introduction to Technical Drawings • Introduction to CAD (Computer Aided Drawing) • Work-Based Learning: Career Coaching, Job Shadowing	• Introduction to Problem Solving Failure Analysis • Simple Machines • Computer Programs • Collecting and Analyzing Data, Statistics • Ethics • Work-Based Learning: Career Coaching, Job Shadowing • Final Project Presentations • Course Wrap-Up and Evaluation

Syracuse City School District
Career and Technical Education Program
Scope and Sequence
Level 200: Engineering Design and Development

Time Frame Unit of Study	Key Questions	Key Learning Targets (Students will know and be able to)	Assessment Evidence of Learning	CCTC Standards	NYS Standards
Weeks 1-2 **Introduction to Course, Classroom Practices, and Expectations**	• What the goals and expectations of this class? • How can students be successful in this course? • What procedures and safety practices will be important in this class? • How can students manage their time? • How can students appropriately and effectively use classroom technology?	• Explain and follow classroom procedures. • List and explain classroom rules and safety precautions and procedures. • Use tools to effectively manage their time. • Use tools and equipment safely and effectively.	• Time Management Assessment • Safety Quiz • Compliance with Safety Rules and Procedures	**Career Ready Practices** CRP 1,2,4,7,10 **Cluster Standards** ST 4,5 **Pathway Standards** ST-ET 2	**ELA** 9-10R 1,2,4 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6 **Literacy** 9-10RST 1,2,4 9-10WHST 2,5,6,7 **Math** **Science**
Week 3 **Roles and Responsibilities of an Technician**	• What are the roles and responsibilities of technicians? • What are the personal attributes of successful technicians? • What are the legal/ethical responsibilities for technicians? • What does teamwork look like in technology?	• Describe the tasks technicians perform. • Define the duties and obligations of technicians. • Describe the personal attributes to consider when pursuing an technology career. • Explain the concept of teamwork in businesses employing technicians.	• Questions for Guest Speaker • Quiz: Roles and Responsibilities of Technicians • Group Projects: Attributes Necessary for Success in Technology • Teamwork Problem Solving Activity: Strategic Plan for Collaborating with Other Teams	**Career Ready Practices** CRP 1,2,4,8,10,12 **Cluster Standards** ST 1,4,5 **Pathway Standards** ST-ET 1,2	**ELA** 9-10R 1,2,4,7 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6 **Literacy** 9-10RST 1,2,4,7 9-10WHST 2,5,6,7 **Math** **Science**
Week 4 **Technology Careers**	• What types of technology titles exist within the profession? • What is the demand for technicians? • What are the duties of an technician? • How do legal and ethical concerns impact the public? • What professional organizations and memberships are available to technicians?	• Describe the responsibilities and duties of technicians. • Explain the legal and ethical responsibilities of technology. • Identify the organizations for technology professionals. • Explain the need for policies and regulations for the profession.	• Research Project and Presentations: Selected Technology Careers • Field Trip to Technology Company • Written Assessment: Roles and Responsibilities in the Profession • Group Activity Rubric: Legal and Ethical Responsibilities in Technology • Group Activity Rubric: Current Articles and Research in Ethics in Technology	**Career Ready Practices** CRP 1,2,4,7,10,11 **Cluster Standards** ST 4,5 **Pathway Standards** ST-ET 3,4	**ELA** 9-10R 1,2,4,7 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6 **Literacy** 9-10RST 1,2,4,7 9-10WHST 2,5,6,7 **Math** **Science**
Weeks 5-6	• What is the relationship between English and metric	• Convert English to metric linear measurement.	• Hands-On Test: Use of Measuring Instruments	**Career Ready Practices** CRP 1,2,4,7,11	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7

Time Frame Unit of Study	Key Questions	Key Learning Targets (Students will know and be able to)	Assessment Evidence of Learning	CCTC Standards	NYS Standards
Use of Practical Measuring Tools	linear measurement? • What tools do technicians use for measurement?	• Apply metric measurement to design models. • Identify measurement tools used in mechanical and electrical technology.			9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 2,6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-SM 2	**Math**
					Science
Weeks 7-8 **Mechanical and Electrical Technology**	• What is a mechanical technician? • What is an electrical technician? • How do technicians impact our daily lives? • What are the education requirements for mechanical and electrical technicians? • Where do mechanical and electrical technicians work?	• Define mechanical technology. • Define electrical technology. • Describe the roles and responsibilities of mechanical and electrical technicians. • Explain the education requirements for mechanical and electrical technicians. • Describe the career paths for mechanical and electrical technicians. • Describe the physical settings and types of companies that employ mechanical and electrical technicians.	• Quiz: Application of Technology Terminology • Task Analysis: Technology Steps Needed for the Development of a Selected Product • Research Paper: Mechanical/Electrical Technology Career Paths, Education, And Degree Required • Field Trip to Technology Facility	**Career Ready Practices** CRP 1,2,4,7,10,11	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 4,5	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-SM 3	**Math**
					Science
Weeks 9-10 **Fundamentals of Electricity**	• What is Ohm's Law? • What is a resistor and how are resistors measured? • What are volts, amps and resistance? • What are circuits? • What are the differences between alternating and direct current? • What is engineering and scientific notation?	• Explain Ohm's Law. • Identify volts, amps and resistance in electrical theory. • Use a resistor color code chart. • Define electricity. • Explain ways in which electricity is generated, transmitted, and used. • Describe the how AC and DC are different.	• Vocabulary of Electrical Terms Assignment • Worksheets • Summative Assessments • Performance Evaluations • Skill Sheet Assessment • Quiz: Electrical Symbols	**Career Ready Practices** CRP 1,2,4,7,11	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 4,5	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-SM 3	**Math** A-CED.4
					Science HS-PS 3-5, 3-6
Week 10 **Work-Based Learning:** **Career Coaching, Job Shadowing**	• What can be learned from mechanical and electrical technology professionals?	• Participate in Career Coaching process. • Participate in Job Shadowing process with local mechanical and electrical technology professionals.	• Career Coaching Self-Assessment • Job Shadow Reflection • Professional Portfolio	**Career Ready Practices** CRP 1,2,4,7,8,10,11,12	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards MN 1,4 ST 4,5,6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards MN-PRO 4 ST-ET 1,4 ST-SM 1,2,4	**Math**
					Science
Weeks 11-12	• What are the basic	• Describe the function of the four basic	• Electrical Terminology	**Career Ready Practices** CRP 1,2,4,7,8,11	**ELA** 9-10R 1,2,4,7,8,9

Time Frame Unit of Study	Key Questions	Key Learning Targets (Students will know and be able to)	Assessment Evidence of Learning	CCTC Standards	NYS Standards
Electrical Circuit Components	components of an electrical circuit? • What tools do technicians use for measurement? • What is an electrical schematic?	components of an electrical circuit. • Describe the operation of two types of power supplies. • Draw a schematic sing the symbols for circuit components.	Quiz • Performance Quiz: Calculating and Measuring Volts, Ohms, Amps • Troubleshooting a Simple Circuit		9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 1	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-ET 2,4	**Math** A-CED.4
					Science HS-PS 3-6 HS-ETS 1-2, 1-3
Weeks 13-14 **Input/Output Devices**	• What are manual input devices? • What is the meaning of NO and NC? • What are three manual input devices? • Why do technicians use electrical schematic drawings for manual input devices?	• Identify each manual input device. • Explain the difference between NO and NC. • Draw an electrical schematic and legend. • Construct a circuit using input and output device by reading a schematic.	• Performance Task: Construct a Simple Circuit • Troubleshooting a Simple Circuit	**Career Ready Practices** CRP 1,2,4,8,11	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 3,6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-ET 1,2,3	**Math** A-CED.4
					Science HS-PS 3-6 HS-ETS 1-2, 1-3
Weeks 15-22 **Mechanical Drive Systems:** **Key Fasteners, Power Transmission, Spur Gears and Multiple Shaft Drives, V-Belt and Chain Drives**	• What is the function of a mechanical drive? • What are the methods of rotary mechanical power? • Why are safety rules for power transmission equipment important? • When is lockout/tagout used? • What methods are applied to check RPM? • What are the different types of fasteners? • What are keys and keyseats? • How are shafts assembled? • What are the methods of loading a mechanical drive system? • What is mechanical efficiency and how is it calculated? • How are shafts specified and used in machinery and what is the purpose of shaft alignment? • What is the function of a bearing and how are they	• Explain the function of a mechanical drive. • Identify the mechanical advantage of each drive system. • Give an example of for each type of drive system. • Explain and demonstrate a lockout/tagout procedure. • Name and assemble three types of foundations. • Use set-up devices. • Identify and apply different fasteners in an installation. • Calculate and verify RPMs. • Identify and give an example of keys and keyseats. • Measure and cut a key from stock. • Assemble a motor coupling. • Calculate mechanical efficiency. • Explain the function of a shaft and identify shaft sizes from samples. • Categorize bearings from a sample. • Install a motor shaft and bearing assembly.	• Performance Evaluations • Application of Safety Rules in Practical Situations • Quiz/Test • Individual Projects: Constructing a Functioning Simple Machine • Lab Practicals • Worksheets • Vocabulary Assignment • Research Project: Application of a Gear Drive System • Unit Exam	**Career Ready Practices** CRP 1,2,4,8,11	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 3 MN 6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-ET 1,2,3 ST-SM 1 MN-HSE 1	**Math** A-CED 2,4 F-IF.4,6 S-IC.4 A-REI.1,6 F-TF.1 N-Q.1
					Science HS-PS 2-1, 3-3 HS-ETS 1-2, 1-3

Time Frame Unit of Study	Key Questions	Key Learning Targets (Students will know and be able to)	Assessment Evidence of Learning	CCTC Standards	NYS Standards
	loaded? • What are the types and functions of couplings? • How do the three components of a gear drive system function? • How are speed, torque, and ratios calculated? • What is a compound gear system? • How is gear rotation determined? • How is a multiple shaft system aligned? • What is backlash and how is it determined? • What are the basic types and components of a belt and chain drive? • How is a belt size determined? • What is pitch? • What is tension and deflection?	• Recognize where and when to use a coupling. • Problem-solve shaft alignment and misalignment. • Demonstrate the use of measuring devices in shaft alignment. • Describe the three functions of a gear drive system. • Calculate pitch, speed, torque, and ratios. • Calculate gear pitch, circle, and diameters. • Define the twelve dimensions of a gear. • Describe the features of a gear drive system. • Diagnose and correct backlash. • Calculate speed and torques in a multiple shaft system. • Describe a compound gear system. • Identify belt and chain types. • Identify the basic components of a belt or chain drive system. • Measure and size V-belt.			
Week 20 **Work-Based Learning:** **Career Coaching, Job Shadowing**	• What can be learned from mechanical and electrical technology professionals?	• Participate in Career Coaching process. • Participate in Job Shadowing process with local mechanical and electrical technology professionals.	• Career Coaching Self-Assessment • Job Shadow Reflection • Professional Portfolio	**Career Ready Practices** CRP 1,2,4,7,8,10,11,12	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards MN 1,4 ST 4,5,6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards MN-PRO 4 ST-ET 1,4 ST-SM 1,2,4	**Math** **Science**
Weeks 23-26 **Introduction to Technical Drawings**	• What is the terminology of technical drawings? • What are isometric, oblique and orthographic drawings and designs? • What are basic line conventions? • What is the purpose of multi-view drawings? • How are geometric shapes used in technical drawings?	• List and explain the views of each drawing. • Define isometric, oblique and orthographic as they apply to technical drawing. • Explain basic line conventions. • Describe uses for multi-view drawings. • Apply basic drawing techniques to project design.	• Application of Terminology in Presentations and Discussions • Application of Simple Drawing Techniques to Basic Projects	**Career Ready Practices** CRP 1,2,4,8,11	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 1	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-ET 2,4	**Math** N-Q.1 **Science** HS-PS 3-1
Weeks 27-29	• What is CAD?		• Quiz on Terminology	**Career Ready Practices** CRP 1,2,4,8,11	**ELA** 9-10R 1,2,4,7,8,9

Time Frame Unit of Study	Key Questions	Key Learning Targets (Students will know and be able to)	Assessment Evidence of Learning	CCTC Standards	NYS Standards
Introduction to CAD (Computer Aided Drawing)	• What are some different types of CAD applications? • What is important to consider in using CAD?	• Describe essential drawing tools in CAD. • Apply CAD drawing applications to basic designs. • Differentiate between CAD and other drawing tools.	• Written Critique: Pros and Cons of CAD • Application of CAD Software in Project Design		9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-ET 1	**Math** N-Q.1
					Science HS-PS 3-1
Week 30 **Work-Based Learning:** **Career Coaching, Job Shadowing**	• What can be learned from mechanical and electrical technology professionals?	• Participate in Career Coaching process. • Participate in Job Shadowing process with local mechanical and electrical technology professionals.	• Career Coaching Self-Assessment • Job Shadow Reflection • Professional Portfolio	**Career Ready Practices** CRP 1,2,4,7,8,10,11,12	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards MN 1,4 ST 4,5,6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards MN-PRO 4 ST-ET 1,4 ST-SM 1,2,4	**Math** **Science**
Weeks 30-32 **Introduction to Problem Solving Failure Analysis**	• What is the importance of problem-solving and how do technicians apply problem-solving skills? • Why is failure analysis important to technicians and what is its impact?	• Explain the application of problem solving to the design process. • Analyze and troubleshoot designs. • Analyze structural integrity. • Explain why structures fail.	• Technical Drawings for Bridge Project • Summary Report: Bridge Project	**Career Ready Practices** CRP 1,2,4,7,8,11	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 1,2	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-ET 5	**Math** SIC.1 SID.1.2.4.6 S-CP.1 F-LE.1
					Science HS-ETS 1-2, 1-3
Weeks 33-34 **Simple Machines**	• What are the six classic machines? • How are the six machines similar and different? • How can I apply what I know in a final project?	• Identify the six classic machines and explain their use. • Distinguish similarities and differences of the six simple machines • Apply collaborative and critical thinking skills to project planning and development. • Develop a final project proposal.	• Group Projects: Construct a Functioning Simple Machine- • Written Final Project Proposal	**Career Ready Practices** CRP 1,2,3,4,8,9,11	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-ET 2,5	**Math** G-SRT.6,.8 A-CED.4
					Science

Time Frame Unit of Study	Key Questions	Key Learning Targets (Students will know and be able to)	Assessment Evidence of Learning	CCTC Standards	NYS Standards
					HS-PS 2-1, 3-3 HS-ETS 1-2, 1-3
Week 35 **Computer Programs**	• What are the common programs used in technology? • How have programs improved today's production processes?	• Compare and contrast traditional technical drawing and CAD. • Explain how computer technology software aids in the production process.	• Application of Technology Software in Product Design Exercises	**Career Ready Practices** CRP 1,2,4,7,8,11	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 1,2	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-ET 2,5	**Math** A-CED.1,4
					Science HS-ETS 1-2, 1-3
Week 36 **Collecting and Analyzing Data, Statistics**	• What methods of data collection are used in product and production analysis? • What is Statistical Process Control (SPC) and how is it used by technicians? • How is the data analyzed?	• Explain the importance of Statistical Process Control (SPC). • Analyze product data to predict product outcomes. • Compose product outcomes for sets of data.	• Written Report: Root Cause of Failure Through Analysis of Given Problem and Data	**Career Ready Practices** CRP 1,2,4,7,8,11	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 1,2	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-SM 4	**Math** SIC.1 SID.1.2.4.6 S-CP.1 F-LE.1
					Science
Week 37 **Ethics**	• What are ethics? • What are the ethical obligations of technicians? • What are the results of non-ethical practices?	• Explain how technology decision are based on ethical decisions. • Explain the relationship between ethical decisions and product safety.	• Research Paper: Ethical Impact of Product Failures	**Career Ready Practices** CRP 1,2,4,9,10	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 3	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-ET 6	**Math**
					Science HS-ETS 1-1
Week 37 **Work-Based Learning:** **Career Coaching, Job Shadowing**	• What can be learned from mechanical and electrical technology professionals?	• Participate in Career Coaching process. • Participate in Job Shadowing process with local mechanical and electrical technology professionals.	• Career Coaching Self-Assessment • Job Shadow Reflection • Professional Portfolio	**Career Ready Practices** CRP 1,2,4,7,8,10,11,12	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards MN 1,4 ST 4,5,6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7

Time Frame Unit of Study	Key Questions	Key Learning Targets (Students will know and be able to)	Assessment Evidence of Learning	CCTC Standards	NYS Standards
				Pathway Standards MN-PRO 4 ST-ET 1,4 ST-SM 1,2,4	**Math** **Science**
Weeks 38-39 **Final Project Presentations**	• How can I apply what I know in a final project?	• Apply technology principles and knowledge to a topic as a final project. • Evaluate peer projects and provide growth-producing feedback.	• Final Project with Peer and Instructor Rubrics	**Career Ready Practices** CRP 1,2,4,7,8,9,11	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-ET 5	**Math** **Science** HS-ETS 1-2, 1-3
Week 40 **Course Wrap-Up and Evaluation**	• How can I apply what I know in a final project? • What have I learned?	• Apply technology principles and knowledge to a final project topic. • Review for final exam.	• Final Exam	**Career Ready Practices** CRP 1,2,4,7,8,9,11	**ELA** 9-10R 1,2,4,7,8,9 9-10W 2,5,6,7 9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-ET 5	**Math** **Science**

Syracuse City School District
Career and Technical Education Program
Course Syllabus
Level 300: Mechanical Technology 300

Program Overview

The PTECH Mechanical Technology program provides students with the opportunity to learn the fundamentals of mechanical technology toward the goal of earning college credits and an Associate's degree in Mechanical Technology from Onondaga Community College. Students will learn fundamental concepts about mechanical systems and electrical circuits, and the operation of mechanical and electronic equipment. Students will gain hands-on experience in using measuring tools, simple machines, machine tools, and computer software to analyze and design mechanical systems. Students will explore and utilize the latest technological advancements in computer drafting and computer-aided design. Students will construct, test, analyze, trouble-shoot and repair simple and complex systems using real world tools and technologies. Student will learn techniques for data collection and analysis, and the process of failure analysis. Students will also learn about the importance of ethical conduct and will develop the critical and analytical thinking, troubleshooting and problem-solving skills necessary for success in the mechanical technology field. Students will explore the different career pathways available within the field of mechanical technology and have the opportunity to apply and enhance their skills through multiple work-based experiences.

Course Description

In this course students will learn about the role of mechanical technology in society and learn and apply skills in digital technologies, concepts, and terminologies. Students will learn the necessary skills to interpret and construct technology drawings, including drawing interpretation, orthographic projection systems, dimensioning, geometric dimensioning and tolerancing. In addition, students will study the basic theory and have hands-on experiences with lathes, milling, drilling, grinding, bench work and shaping operations. Students will learn about cutting speeds, and surface finishes, as well as machine capabilities. Students will be introduced to the fundamental concepts and techniques of machine tool practices including the use of hand tools, dimensional measurement, materials, layout, and various machining operations. Students will learn and begin to apply fundamental right triangle trigonometry utilizing geometric relations. Students will work collaboratively as part of a team to create, problem-solve and present projects that address authentic issues in the community and will learn and apply standard technology nomenclature within the context of their projects. Professionalism, critical thinking and problem-solving skills, and accurate and appropriate oral and written communication will continue to be emphasized and developed.

Work-Based Learning

Students will connect with working mechanical technology professionals through field trips, job shadowing and Career Coaching, leading to opportunities for direct job training and real-world experiences. Students will create and maintain a portfolio of their experiences to document the development of their skills, including a professional resume and employability profile.

Additional Learning Opportunities

- **Micro-credentials:** Students may pursue learning experiences and credentials depending on the requirements of the projects that they are involved in. Some examples for this pathway include, but are not limited to:
    - OSHA-10 General Industry Safety Certification
    - OSHA-30 General Industry Safety Training
    - Digital Multimeter Certification
    - CompTIA ITF+ Certification: IT Fundamentals
    - CompTIA Tech+ Certification
    - Other relevant certifications as they become available through industry collaborations, teacher certifications and student interest.
- **Summer Bridge Enrichment:** Students will have the opportunity to participate in cross-curricular Summer Bridge programs to enhance and enrich their skills. Students will explore and create solutions that address authentic needs in the school and wider community with the involvement of local industry professionals. Students will build on skills learned during the school year to work collaboratively with students from other pathways and programs.

Pre-Requisites

Level 100: Engineering Design, Level 200: Engineering Design and Development, Regents Math

Course Objectives

Students will:

- Interpret and construct technology drawings.
- Utilize safety practices pertaining to a machine tools lab.
- Safely and effectively use various hand tools, precision, and semi-precision measurement tools.
- Safely and effectively use tools for sawing, drilling, vertical and horizontal milling, grinding, turning, threading, and knurling.
- Apply basic skills, search techniques, and research methodologies in authentic situations.

Integrated Academics

1 CTE Integrated Science Credit

Concurrent Enrollment College Credit

Upon successful completion of Level 300: Mechanical Technology 300, students will earn 3 college credits for each of the following courses from Onondaga Community College:

- MET 161: Engineering Drawing
- MET 151: Machine Tools 1

Equipment and Supplies

- **School will provide:** Computer hardware and software, all necessary instruments and equipment
- **Student will provide:** Necessary school supplies

Textbook

Giesecke, Frederick E., et al. *Technical Drawing with Engineering Graphics 15th Edition*. Hoboken, NJ: Peachpit Press, 2016.

Hoffman, Peter J. and Eric S. Hopewell. *Precision Machining Technology*. Boston, MA: Cengage, 2019.

Grading

Quarters 1 and 2		**Quarters 3 and 4**	
• Assigned Coursework	25%	• Assigned Coursework	25%
• Lab Projects	25%	• Lab Projects	25%
• Quizzes and Assessments	25%	• Quizzes and Assessments	25%
• Professionalism and Participation	25%	• Professionalism and Participation	25%

Additional Course Policies

- Missed Classes: You are responsible for the activities of each class period. If you know of a conflict ahead of time, you are welcome to submit projects early. If you do not take a test on the scheduled day, contact the instructor for a makeup.
- Assignments: All assignments are due at the end of class on the date due. Late assignments receive partial credit.
- Academic Dishonesty: Plagiarism and cheating are serious offenses and may be penalized by a failing grade.

Course Calendar

300 **11th Grade**	
1 and 2	**3 and 4**

• Classroom Practices: Being Successful
• Personal and Professional Characteristics in Mechanical Technology
• Workplace Safety: OSHA 10 Certification
• MET 161: Engineering Drawing
• Work-Based Learning: Career Coaching, Job Shadowing
	• MET 151 Machine Tools 1
	  ○ Shop Safety, Reading Drawings, and Hand Tools
	  ○ Dimensional Measurement
	  ○ Materials and Layout
	  ○ Introduction to Machine Tools
	  ○ Sawing and Drilling
	  ○ Turning and Milling
	  ○ Grinding and Right Triangle Trigonometry
	• Work-Based Learning: Career Coaching, Job Shadowing

Syracuse City School District
Career and Technical Education Program
Scope and Sequence
Level 300: Mechanical Technology 300

First Quarter and Second Quarters					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Classroom Practices: Being Successful **Personal and Professional Characteristics in Mechanical Technology**	• What are the expectations for the classroom and hands-on mechanical technology lab? • How can students be successful in this class? • What strategies can students use to manage their time? • How can students use technology appropriately and effectively? • What strategies can students use to study effectively to prepare for tests? • What are the essential personal and professional characteristics of a mechanical technician? • What are the professional characteristics necessary for success in the technology field? • How do personal habits influence others?	• Explain and follow classroom procedures. • List and follow rules for general classroom safety. • Evaluate ways to manage time. • Investigate various study skills for test taking and identify two effective skills. • Describe the roles and responsibilities a mechanical technician has in a professional workplace. • Describe personal and professional attributes. • Reflect and self-assess personal habits and attitudes. • Develop employability goals appropriate for the profession.	• Career Exploration Research Project • Safety Quiz • Self-Assessment • Lab Procedure Practical • Poster and Presentation • Demonstration of Classroom Procedures and Safety Practices • Employability Profile	**Career Ready Practices** CRP 1,2,4,7,10,11 **Cluster Standards** MN 1,4 ST 3,4,5 **Pathway Standards** ST-ET 4 ST-SM 3	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6 **Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7 **Math** **Science**
Workplace Safety **OSHA 10 Certification**	• What are the causes and consequences of the most common types of workplace incidents? • How is personal protective equipment (PPE) used to protect workers from different types of injuries? • What are the guidelines for the safe use of hand and power tools? • What is the role of the OSHA in job-site safety?	• Demonstrate the use of shop safety equipment, including eye wash stations, hand wash stations, first aid kits, and fire extinguishers. • Demonstrate the use and care of appropriate personal protective equipment, including safety glasses, face shields, respirators, hard hats, gloves, hearing protection and protective clothing and footwear. • Dispose of hazardous materials and wastes appropriately. • Use common hand and power tools safely. • Use a lockout/tagout/blockout program to properly disable a system. • Demonstrate basic safety protocols for working with mechanical systems. • Identify, activate and deactivate internal machine safety devices, including	• Research Project • Self-Assessment • Professional Portfolio • Class Presentation	**Career Ready Practices** CRP 1,2,3,4,5,8,11,12 **Cluster Standards** MN 3,5 ST 3 **Pathway Standards** MN-PPD 3 MN-PRO 2,3,4,5 ST-ET 1,4 ST-SM 4	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6 **Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7 **Math** **Science**

First Quarter and Second Quarters					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		emergency stops and deadman switches. • Explain how to interact safely with work envelopes including assessing risks associated with the movements of machine and automated components. • Pursue OSHA 10 certification.			
MET 161: Engineering Drawing	• What is the alphabet of lines? • What techniques are used for sketching and lettering in technical drawing? • What drawing instruments are used in technology drawings? • How are technology drawings interpreted? • How are multi-view drawings constructed utilizing orthographic principles? • How are sectional views constructed? • How are assembly drawings produced from working drawings ? • How are basic technology drawings dimensioned? • How are technology drawings that utilize geometric dimensioning and tolerancing principles analyzed?	• Explain the alphabet of lines. • Explain and demonstrate the are used for sketching and lettering in technical drawing. • Utilize appropriate drawing instruments in technology drawings. • Interpret technology drawings. • Construct multi-view drawings utilizing orthographic principles. • Construct sectional views. • Produce assembly drawings from working drawings. • Dimension basic technology drawings. • Analyze technology drawings that utilize geometric dimensioning and tolerancing principles.	• Homework Assignments. • CAD Labs Assignments • Quizzes and Final Exam	**Career Ready Practices** CRP 1,2,4,8,11	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6
				Cluster Standards MN 6 ST 6	**Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7
				Pathway Standards ST-ET 1,2,3,5,6 ST-SM 1,2,3,4	**Math**
					Science
Work-Based Learning: **Career Coaching, Job Shadowing**	• What can be learned from mechanical technology professionals?	• Participate in Career Coaching process. • Participate in Job Shadowing process with local mechanical technology professionals.	• Career Coaching Self-Assessment • Job Shadow Reflection • Professional Portfolio	**Career Ready Practices** CRP 1,2,4,7,8,10,11,12	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6
				Cluster Standards MN 1,4 ST 4,5,6	**Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7
				Pathway Standards MN-PRO 4 ST-ET 1,4 ST-SM 1,2,4	**Math**
					Science

Third Quarter and Fourth Quarters					
Unit	**Key Questions**	**Key Learning Targets (Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
MET 151: Machine Tools 1 **Shop Safety, Reading Drawings, and Hand Tools**	• What safety practices pertain to a machine tools shop? • What are the three basic elements of a drawing? • What are commonly used abbreviations and terminology in shop drawings? • What are the seven main steps in reading a print? • How are common hand tools used? • How are necessary work holding devices and hand tools selected?	• Explain and demonstrate safety practices pertaining to a machine tools lab including personal protective equipment (PPE). • Identify the three basic elements of a print. • Interpret commonly used abbreviations and terminology. • Identify the types of dimensions. • Identify general note symbols and locate them on a print. • List the seven main steps in reading a print. • Identify common hand tools and describe their basic applications. • Demonstrate proper use of hand tools. • Select necessary work holding devices and hand tools as dictated by the size and shape of the part and the machining to be done.	• Homework Assignments • Quizzes/Tests • Shop Projects	**Career Ready Practices** CRP 1,2,4,8,11,12 **Cluster Standards** MN 3,6 ST 6 **Pathway Standards** MN-PPD 1,3 MN-PRO 2,3,5 ST-ET 1,2,3,6 ST-SM 1,2,4	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6 **Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7 **Math** **Science**
MET 151: Machine Tools 1 **Dimensional Measurement**	• How is precision measurement equipment used and maintained? • What are some basic semi-precision and precision measuring tools? • How are semi-precision and precision measuring tools read? • What factors affect accurate measurement? • What is the difference between accuracy and precision? • What is the main purpose of calibration? • What are the key factors that affect calibration?	• Demonstrate the proper selection, use, and care of precision measurement equipment. • Identify basic semi-precision measuring tools and describe their major applications. • Demonstrate proper reading of semi-precision measuring tools to their finest graduation. • Identify precision measuring tools and describe their major applications. • Demonstrate accurate reading of precision measuring tools to their finest graduation. • Justify the use of a particular measuring tool based on tool and part characteristics. • Describe factors affecting accurate measurement, including dirt, temperature, improper measuring, and tool calibration. • Describe how measurement tool selection can contribute to part accuracy and inaccuracy. • Distinguish between accuracy and precision. • Describe the main purpose of calibration. • Identify the key factors that affect calibration	• Homework Assignments • Quizzes/Tests • Shop Projects	**Career Ready Practices** CRP 1,2,4,8,11,12 **Cluster Standards** MN 3,6 ST 6 **Pathway Standards** MN-PPD 1,3 MN-PRO 2,3,5 ST-ET 1,2,3,6 ST-SM 1,2,4	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6 **Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7 **Math** **Science**
MET 151: Machine Tools 1 **Materials and Layout**	• What are four types of manufacturing materials and how are they used? • What are the physical, mechanical and chemical	• Identify four types of manufacturing materials and their common uses in manufacturing processes. • Define physical, mechanical and chemical properties.	• Homework Assignments • Quizzes/Tests • Shop Projects	**Career Ready Practices** CRP 1,2,4,8,11,12 **Cluster Standards**	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6 **Literacy**

Third Quarter and Fourth Quarters					
Unit	**Key Questions**	**Key Learning Targets (Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	properties of materials and how do they relate to manufacturing applications? • How are materials classified? • What are the layout practices using a precision surface plate?	• Explain the physical properties of materials, including density, specific heat, melting and boiling point, thermal expansion and conductivity, electrical and magnetic properties. • Describe how physical properties of materials relate to manufacturing applications. • Explain the mechanical properties of materials, including strength, toughness, hardness, ductility, elasticity, fatigue and creep. • Describe how mechanical properties of materials relate to manufacturing applications. • Explain the chemical properties of materials, including oxidation, corrosion, flammability, and toxicity. • Describe how chemical properties of materials relate to manufacturing applications. • Explain the classification system for metals, plastics and polymers, and ceramics and glass. • Describe the physical, mechanical and chemical properties of metals, plastics and polymers, and ceramics and glass. • Explain layout practices using a precision surface plate.		MN 3,6 ST 6 **Pathway Standards** MN-PPD 1,3 MN-PRO 2,3,5 ST-ET 1,2,3,6 ST-SM 1,2,4	11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7 **Math** **Science**
MET 151: Machine Tools 1 **Introduction to Machine Tools**	• What common machine tools are used in an industrial setting? • How were machine tools developed? • What is the importance and use of measurement and calibration when using machine tools? • What is the importance of watching gauges, dials or other indicators? • How are tools and equipment selected to do a specific job? • How are causes of operating errors determined?	• List and describe common machine tools used in an industrial setting. • Summarize the history and development of machine tools. • Explain the importance and use of measurement and calibration when using machine tools. • Explain the importance of watching gauges, dials or other indicators to make sure a machine is working properly. • Explain the importance of determining the kind of tools and equipment needed to do a job. • Explain the importance of determining causes of operating errors and deciding what to do about it. • Explain the importance of conducting tests and inspections of products, services or	• Homework Assignments • Quizzes/Tests • Shop Projects	**Career Ready Practices** CRP 1,2,4,8,11,12 **Cluster Standards** MN 3,6 ST 6 **Pathway Standards** MN-PPD 1,3 MN-PRO 2,3,5 ST-ET 1,2,3,6 ST-SM 1,2,4	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6 **Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7 **Math** **Science**

Third Quarter and Fourth Quarters					
Unit	**Key Questions**	**Key Learning Targets (Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	• Why is it important to conduct tests and inspections of products, services, or processes? • What is the importance of performing routine maintenance on equipment? • What is the purpose and use of the Machinery's Handbook? • What safety rules are important in the machine shop? • How are work holders used in machine tool operation?	processes to evaluate quality or performance. • Explain the importance of performing routine maintenance on equipment and determining when and what kind of maintenance is needed. • Explain the purpose and use of the Machinery's Handbook. • Observe appropriate safety rules pertaining to general machine shop practices. • Explain the use of work holders in machine tool operation.			
MET 151: Machine Tools 1 **Sawing and Drilling**	• How are different types of sawing equipment used? • What are different types of drill presses found in the machine shop and how are they used? • How is a drill press used and maintained? • How are drill speeds accurately calculated for specific drill press operations?	• Explain the process of sawing using different types of sawing equipment. • Identify the different types of drill presses found in the machine shop and describe their major applications. • Identify the standard drilling and reaming tools and describe their characteristics and major applications. • Demonstrate the proper cleaning, and care of the drill press. • Properly set up the drill press and demonstrate the selection of the most appropriate and sharp drilling tool(s). • Demonstrate proper use of drilling machines. • Use applicable reference material to accurately calculate speeds for assigned drill press operations.	• Homework Assignments • Quizzes/Tests • Shop Projects	**Career Ready Practices** CRP 1,2,4,8,11,12 **Cluster Standards** MN 3,6 ST 6 **Pathway Standards** MN-PPD 1,3 MN-PRO 2,3,5 ST-ET 1,2,3,6 ST-SM 1,2,4	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6 **Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7 **Math** **Science**
MET 151: Machine Tools 1 **Turning and Milling**	• How is a lathe used and maintained? • What are the sizes and applications of common types of metal cutting lathes? • What are turning, threading, and knurling? • How are lathe speeds and depths of cuts calculated?	• Demonstrate proper use of metal lathes. • Demonstrate the proper cleaning, lubrication, and care of the metal lathe. • Identify and describe the sizes and applications of common types of metal cutting lathes. • Explain and demonstrate the processes of turning, threading, and knurling using a lathe. • Identify common parts and demonstrate the proper use of all controls and adjustments on the lathe.	• Homework Assignments • Quizzes/Tests • Shop Projects	**Career Ready Practices** CRP 1,2,4,8,11,12 **Cluster Standards** MN 3,6 ST 6 **Pathway Standards** MN-PPD 1,3 MN-PRO 2,3,5 ST-ET 1,2,3,6 ST-SM 1,2,4	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6 **Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7 **Math** **Science**

Third Quarter and Fourth Quarters					
Unit	**Key Questions**	**Key Learning Targets (Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	• How are vertical and horizontal milling machines used and maintained? • What are common cutters and their applications? • How are speeds and feeds calculated for an assigned vertical or horizontal milling machine operation?	• Identify and demonstrate the proper installation and application of standard tools and tool holders for the lathe. • Identify common work holding devices and demonstrate proper procedure for changing and installing them. • Use appropriate reference material to accurately calculate relevant lathe speeds and depths of cuts as required for an assigned application. • Demonstrate proper use of vertical and horizontal milling machines. • Demonstrate the proper setup, operation, care, cleaning, and lubrication of vertical and horizontal milling machines. • Correctly identify common cutters and explain their basic applications. • Identify and demonstrate the proper use of all controls and adjustments on vertical and horizontal milling machines. • Identify the common work holding devices and select the most appropriate device based on part shape and type of machining to be done. • Select the proper cutter and work holding device and demonstrate their proper installation and setup for an assigned vertical or horizontal milling operation. • Use applicable reference material to accurately calculate speeds and feeds for an assigned vertical or horizontal milling machine operation.			
MET 151: Machine Tools 1 **Grinding and Right Triangle Trigonometry**	• What are the benefits of grinding? • What are the differences and applications of common types of grinding machines? • What are the processes of off-hand grinding and surface grinding? • How are grinding machines used and maintained? • How are grinding wheels and grinding fluids selected and used?	• Describe the benefits of grinding. • Identify common types of grinding machines and describe the major differences and applications. • Explain and demonstrate the processes of off-hand grinding and surface grinding. • Demonstrate proper use of grinding abrasive machines. • Describe and demonstrate the proper cleaning, lubrication, and care of precision grinding machines. • Explain the identification, selection and application of common grinding wheels. • Describe the proper selection and application of grinding fluids.	• Homework Assignments • Quizzes/Tests • Shop Projects	**Career Ready Practices** CRP 1,2,4,8,11,12 **Cluster Standards** MN 3,6 ST 6 **Pathway Standards** MN-PPD 1,3 MN-PRO 2,3,5 ST-ET 1,2,3,6 ST-SM 1,2,4	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6 **Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7 **Math** **Science**

Third Quarter and Fourth Quarters					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	• What are common problems and solutions in surface grinding? • What are types of automatic protections built into grinding machines? • How are trigonometric formulas used for solving problems with right triangles and how are these applied in the machine shop?	• Describe common problems and solutions in surface grinding. • Describe the importance of safety during grinding. • Identify types of automatic protections built into grinding machines. • Explain and apply trigonometric formulas for solving problems with right triangles in the machine shop.			
Work-Based Learning: **Career Coaching, Job Shadowing**	• What can be learned from mechanical technology professionals?	• Participate in Career Coaching process. • Participate in Job Shadowing process with local mechanical technology professionals.	• Career Coaching Self-Assessment • Job Shadow Reflection • Professional Portfolio	**Career Ready Practices** CRP 1,2,4,7,8,10,11,12	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6
				Cluster Standards MN 1,4 ST 4,5,6	**Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7
				Pathway Standards MN-PRO 4 ST-ET 1,4 ST-SM 1,2,4	**Math** **Science**

Syracuse City School District
Career and Technical Education Program
Course Syllabus
Level 400: Mechanical Technology 400

Program Overview

The PTECH Mechanical Technology program provides students with the opportunity to learn the fundamentals of mechanical technology toward the goal of earning college credits and an Associate's degree in Mechanical Technology from Onondaga Community College. Students will learn fundamental concepts about mechanical systems and electrical circuits, and the operation of mechanical and electronic equipment. Students will gain hands-on experience in using measuring tools, simple machines, machine tools, and computer software to analyze and design mechanical systems. Students will explore and utilize the latest technological advancements in computer drafting and computer-aided design. Students will construct, test, analyze, trouble-shoot and repair simple and complex systems using real world tools and technologies. Student will learn techniques for data collection and analysis, and the process of failure analysis. Students will also learn about the importance of ethical conduct and will develop the critical and analytical thinking, troubleshooting and problem-solving skills necessary for success in the mechanical technology field. Students will explore the different career pathways available within the field of mechanical technology and have the opportunity to apply and enhance their skills through multiple work-based experiences.

Course Description

In this final course of the pathway, students will use mechanical technologies to apply their knowledge and skills to real-life processes and problems to design and manufacture metal parts using various machine tools and equipment. There will be an ongoing focus on workplace safety and the application of skills in measurement and the use of machine tools. Students will focus on areas of particular interest to develop and implement two research projects. Students will work collaboratively as part of a team to create, problem-solve and present projects that address authentic issues in the community and will learn and apply standard technology nomenclature within the context of their projects. Students will also participate in field-based internships where they will work with industry professionals to apply technology theory in authentic industry environments. Professionalism, critical thinking, design theory, problem-solving and analysis, and accurate and appropriate oral and written communication will continue to be emphasized and developed.

Work-Based Learning

Students will connect with working mechanical technology professionals through field trips, job shadowing Career Coaching and job internships, leading to opportunities for direct job training and real-world experiences. Students will create and maintain a portfolio of their experiences to document the development of their skills, including a professional resume and employability profile.

Additional Learning Opportunities

- **Micro-credentials:** Students may pursue learning experiences and credentials depending on the requirements of the projects that they are involved in. Some examples for this pathway include, but are not limited to:
    - OSHA-10 General Industry Safety Certification
    - OSHA-30 General Industry Safety Training
    - Digital Multimeter Certification
    - CompTIA ITF+ Certification: IT Fundamentals
    - CompTIA Tech+ Certification
    - Other relevant certifications as they become available through industry collaborations, teacher certifications and student interest.
- **Summer Bridge Enrichment:** Students will have the opportunity to participate in cross-curricular Summer Bridge programs to enhance and enrich their skills. Students will explore and create solutions that address authentic needs in the school and wider community with the involvement of local industry professionals. Students will build on skills learned during the school year to work collaboratively with students from other pathways and programs.

Pre-Requisites

Level 100: Engineering Design, Level 200: Engineering Design and Development, Level 300: Mechanical Technology 300

Course Objectives

Students will:

- Develop employability goals appropriate for the profession.
- Obtain general industry OSHA 10 certification.
- Complete two comprehensive research projects that addresses an authentic problem or issue.
- Analyze technical data and apply technology theory.
- Demonstrate knowledge and skills learned in MET 151: Machine Tools 1.
- Demonstrate knowledge and skills learned in MET 152: Machine Tools 2.
- Participate in Career Coaching process.
- Participate in Job Shadowing processes with local mechanical technology professionals.
- Complete an Internship with local mechanical technology professionals.
- Demonstrate professionalism in an industry environment with professionals.

Integrated Academics

1 CTE Integrated Math Credit

Concurrent Enrollment College Credit

Upon successful completion of Level 400, students will earn 3 college credits for MET 152: Machine Tools 2 from Onondaga Community College:

Equipment and Supplies

- **School will provide:** Computer hardware and software, all necessary instruments and equipment
- **Student will provide:** Necessary school supplies

Textbook

Hoffman, P. J., & Hopewell, E. S. (2019). *Precision Machining Technology.* Boston, MA: Cengage.

Grading

Quarters 1 and 2		**Quarters 3 and 4**	
• Assigned Coursework.	25%	• Assigned Coursework	20%
• Independent Project	25%	• Independent Project	20%
• Quizzes and Assessments	25%	• Employability Skills	20%
• Professionalism and Participation	25%	• Quizzes and Assessments	20%
		• Professionalism	20%

Additional Course Policies

- Missed Classes: You are responsible for the activities of each class period. If you know of a conflict ahead of time, you are welcome to submit projects early. If you do not take a test on the scheduled day, contact the instructor for a makeup.
- Assignments: All assignments are due at the end of class on the date due. Late assignments receive partial credit.
- Academic Dishonesty: Plagiarism and cheating are serious offenses and may be penalized a failing grade.

Course Calendar

400 **12th Grade**	
1 and 2	**3 and 4**
• Classroom Practices: Being Successful • Personal and Professional Characteristics in Mechanical Technology • Workplace Safety: OSHA 10 Certification • Senior Project • Review of MET 151: Machine Tools 1 • MET 152: Machine Tools 2 • Work-Based Learning: Career Coaching, Job Shadowing	• MET 152: Machine Tools 2 (Continued) • Work-Based Learning: Job Shadowing, Internship

Syracuse City School District
Career and Technical Education Program
Scope and Sequence
Level 400: Mechanical Technology 400

First and Second Quarters					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Classroom Practices: Being Successful **Personal and Professional Characteristics in Mechanical Technology**	• What are the expectations for the classroom and hands-on mechanical technology lab? • How can students be successful in this class? • What strategies can students use to manage their time? • What are the essential personal and professional characteristics of a mechanical technician? • What are the professional characteristics necessary for success in the technology field?	• Explain and follow classroom procedures. • List and follow rules for general classroom safety. • Evaluate ways to manage time. • Describe the roles and responsibilities a mechanical technician has in a professional workplace. • Discussion of personal and professional attributes. • Reflect and self-assess personal habits and attitudes. • Develop employability goals appropriate for the profession.	• Career Exploration Research Project • Safety Quiz • Self-Assessment • Lab Procedure Practical • Demonstration of Classroom Procedures and Safety Practices • Employability Profile • Professional Portfolio	**Career Ready Practices** CRP 1,2,4,7,10,11 **Cluster Standards** MN 1,4 ST 3,4,5 **Pathway Standards** ST-ET 4 ST-SM 3	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6 **Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7 **Math** **Science**
Workplace Safety **OSHA 10 Certification**	• What are the causes and consequences of the most common types of workplace incidents? • How is personal protective equipment (PPE) used to protect workers from different types of injuries? • What are the guidelines for the safe use of hand and power tools? • What is the role of the OSHA in job-site safety?	• Demonstrate the use of shop safety equipment, including eye wash stations, hand wash stations, first aid kits, and fire extinguishers. • Demonstrate the use and care of appropriate personal protective equipment, including safety glasses, face shields, respirators, hard hats, gloves, hearing protection and protective clothing and footwear. • Dispose of hazardous materials and wastes appropriately. • Use common hand and power tools safely. • Use a lockout/tagout/blockout program to properly disable a mechanical system. • Demonstrate basic safety protocols for working with mechanical systems. • Identify, activate, and deactivate internal machine safety devices, including emergency stops and deadman switches. • Interact safely with work envelopes including assessing risks associated with the movements of machine and automated components. • Obtain general industry OSHA 10 certification.	• Research Project • Self-Assessment • Professional Portfolio • Class Presentation • Teacher Observation Checklist	**Career Ready Practices** CRP 1,2,3,4,5,8,11,12 **Cluster Standards** MN 3,5 ST 3 **Pathway Standards** MN-PPD 3 MN-PRO 2,3,4,5 ST-ET 1,4 ST-SM 4	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6 **Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7 **Math** **Science**

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Independent Senior Project	• How can a mechanical technology research project address and authentic problem or issue?	• Develop a comprehensive individual research project that addresses an authentic problem or issue. • Present project proposal to instructor for approval. • Implement research and complete research project. • Present completed research project.	• Research Project Journal • Rubric-Based Evaluation of Project	**Career Ready Practices** CRP 1,2,4,6,7,8,11	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6
				Cluster Standards MN 6 ST 1,2,3,6	**Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7
				Pathway Standards MN-PRO 5 ST-ET 1,2,3,4,5,6 ST-SM 1,2,4	**Math** **Science**
Review of MET 151: Machine Tools 1	• What machine tools are common in manufacturing and how are they used?	• Demonstrate knowledge and skills learned in MET 151 Machine Tools 1, including shop safety, reading drawings, hand tools, dimensional measurement, materials, layout, sawing, drilling, turning, vertical and horizontal milling, grinding, and right-angle trigonometry.	• Homework Assignments • Quizzes/Tests • Shop Lab Assignments	**Career Ready Practices** CRP 1,2,4,8,11,12	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6
				Cluster Standards MN 3,6 ST 6	**Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7
				Pathway Standards MN-PPD 1,3 MN-PRO 2,3,5 ST-ET 1,2,3,6 ST-SM 1,2,4	**Math** **Science**
MET 152: Machine Tools 2	• What is taper turning? • How is a dividing or index head used? • What is broaching? • What is the importance of reading and machining to print? • What are the different classes of fits and how are they related to tolerances? • How are trigonometric formulas used for solving problems with non-right triangles and how are these applied in the machine shop? • How are milling attachments used? • What is heat treating? • How is metal finished? • How are processes and products inspected?	• Explain and demonstrate taper turning. • Explain and demonstrate using a dividing or index head. • Explain and demonstrate broaching. • Explain and demonstrate reading and machining to print. • Explain the different classes of fits and how they are related to tolerances. • Explain and apply trigonometric formulas for solving problems with non-right triangles in the machine shop. • Explain and demonstrate the use of milling attachments. • Explain and demonstrate heat treating. • Explain and demonstrate metal finishes. • Explain and demonstrate inspection of processes and products. • Explain and demonstrate basic programming and operations of numerical control equipment. • Explain and demonstrate applications of jigs and fixtures.	• Homework Assignments • Quizzes/Tests • Shop Lab Assignments	**Career Ready Practices** CRP 1,2,4,8,11,12	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6
				Cluster Standards MN 3,6 ST 6	**Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7
				Pathway Standards MN-PPD 1,3 MN-PRO 2,3,5 ST-ET 1,2,3,6 ST-SM 1,2,4	**Math** **Science**

First and Second Quarters					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	• How is numerical control equipment programmed and operated? • How are jigs and fixtures used? • What is EDM? • How are cutting feeds and speeds determined? • What are different types of surface finishes?	• Explain and demonstrate EDM (Electrical Discharge Machining). • Explain and demonstrate cutting feeds and speeds. • Explain and demonstrate surface finishes.			
Work-Based Learning: **Career Coaching, Job Shadowing**	• What can be learned from mechanical technology professionals?	• Participate in Career Coaching process. • Participate in Job Shadowing process with local mechanical technology professionals.	• Career Coaching Self-Assessment • Job Shadow Reflection • Professional Portfolio	**Career Ready Practices** CRP 1,2,4,7,8,10,11,12	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6
				Cluster Standards MN 1,4 ST 4,5,6	**Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7
				Pathway Standards MN-MIR 2,3,4 MN-PRO 4 ST-ET 1,4 ST-SM 1,2,4	**Math** **Science**

Third and Fourth Quarters					
Unit	**Key Questions**	**Key Learning Targets (Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
MET 152: Machine Tools 2 (Continued)	• What is taper turning? • How is a dividing or index head used? • What is broaching? • What is the importance of reading and machining to print? • What are the different classes of fits and how are they related to tolerances? • How are trigonometric formulas used for solving problems with non-right triangles and how are these applied in the machine shop? • How are milling attachments used? • What is heat treating? • How is metal finished? • How are processes and products inspected? • How is numerical control equipment programmed and operated? • How are jigs and fixtures used? • What is EDM? • How are cutting feeds and speeds determined? • What are different types of surface finishes?	• Explain and demonstrate taper turning. • Explain and demonstrate using a dividing or index head. • Explain and demonstrate broaching. • Explain and demonstrate reading and machining to print. • Explain the different classes of fits and how they are related to tolerances. • Explain and apply trigonometric formulas for solving problems with non-right triangles in the machine shop. • Explain and demonstrate the use of milling attachments. • Explain and demonstrate heat treating. • Explain and demonstrate metal finishes. • Explain and demonstrate inspection of processes and products. • Explain and demonstrate basic programming and operations of numerical control equipment. • Explain and demonstrate applications of jigs and fixtures. • Explain and demonstrate EDM (Electrical Discharge Machining). • Explain and demonstrate cutting feeds and speeds. • Explain and demonstrate surface finishes.	• Homework Assignments • Quizzes/Tests • Shop Lab Assignments	**Career Ready Practices** CRP 1,2,4,8,11,12 **Cluster Standards** MN 3,6 ST 6 **Pathway Standards** MN-PPD 1,3 MN-PRO 2,3,5 ST-ET 1,2,3,6 ST-SM 1,2,4	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6 **Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7 **Math** **Science**
Work-Based Learning: **Job Shadowing, Internship**	• How does an employee convey professionalism in the workplace? • Why are internships necessary? • How does an internship experience contribute to a professional portfolio? • What are areas of improvement and challenge during the internship experience?	• Apply job search techniques to seek out, evaluate and obtain internship opportunities. • Communicate with industry/potential employers through the internship experience. • Apply learned knowledge and skills to workplace situations. • Explain the importance of professionalism and ethics in the workplace. • Comply with workplace policies and regulations. • Communicate effectively both verbally and in writing. • Explain the importance of being prompt, being able to take directions and being motivated to accomplish assigned tasks. • Analyze and resolve problems that arise in completing assigned tasks.	• Self-Assessment • Job Shadow Reflection • Reflection Summary: • Internship Experience • Professional Portfolio • Employability Profile • Internship Checklist • Employer/Mentor Observation Checklist	**Career Ready Practices** CRP 1,2,4,6,8,10,11,12 **Cluster Standards** MN 1,3,4,5,6 ST 1,2,3,5,6 **Pathway Standards** MN-MIR 2,3,4 MN-PRO 1,2,3,4,5 ST-ET 1,2,3,5,6 ST-SM 1,2,4	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6 11-12L 1,2,3,4,5,6 **Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7 **Math** **Science**