Syracuse City School District
Career and Technical Education Program
Course Syllabus
MET100: Mechanical Technology 100

Program Overview

The PTECH Mechanical Technology program provides students with the opportunity to learn the fundamentals of engineering toward the goal of earning college credits and an Associate's degree in Mechanical Technology from Onondaga Community College. Students in the Mechanical Technology program 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, computer-aided design and automated manufacturing. 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 engineering 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 engineering profession. Students will explore different careers, learn more about pathways to selected engineering careers and begin to develop foundational skills in professional and ethical responsibilities. Students will learn fundamental math and science concepts, practical engineering tools, engineering design and the basics of CAD and CAM, air conditioning and refrigeration. Through various work-based experiences, they will learn about the education and licensing requirements, roles and responsibilities, regulatory agencies and work settings for various career pathways within the engineering 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 engineering 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 be connected with working mechanical engineering 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.

Pre-Requisites

N/A

Course Objectives

By the end of this course, students will:

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

Quarter	Units of Study
1	• Introduction to the Program, the School, and the Future • Introduction to Technology and Engineering • The Engineering Design Process • Design and Modeling
2	• Measurement Tools and Techniques • Manufacturing Engineering • Math and Science Connections
3	• Materials and Fabrications • Mechanical Engineering • Electrical Engineering • Electronics
4	• Air Conditioning and Refrigeration • The Engineering Team • Final Class Project • Course Wrap-Up and Evaluation

Syracuse City School District
Career and Technical Education Program
Scope and Sequence
MET 100: Mechanical Technology 100

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 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 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 and Engineering**	• What is the definition of engineering? • What are the connections between science, technology, engineering, and mathematics? • What are some early examples of engineering and great engineering achievements of the past century? • How do major engineering activities compare?	• Define engineering. • Describe how engineering has affected the world in the past and the present. • Identify several early examples of engineering. • Evaluate great engineering achievements of the past century. • Compare and contrast the major engineering activities.	• Engineering Terms Quiz • Research Paper: Engineering Achievements of the Past • Research Assignment: Benefits of the Engineering 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-ETS1-2 HS-ETS1-3
Weeks 5-7 **The Engineering Design Process**	• What is meant by the engineering design process? • What are the common design process steps? • What are the constraints to engineering design? • How can old products or buildings be updated to include new engineering ideas and achievements?	• Outline and describe the engineering design process. • List steps in common design process. • Identify engineering problems and opportunities. • Describe the rationale for detailed documentation. • 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

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
					N-Q.1
					Science HS-ETS1-2 HS-ETS1-3
Weeks 8-10 **Design and Modeling**	• Why is sketching an important part of engineering? • What are the different types of lines used in engineering drawings? • How are the most common views, perspectives and drawing types of engineered 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 engineers. • Recognize the different types of lines in engineering 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 SRT 5,6,8 G-GMD.4 N-Q.1 S-IC.4
					Science HS-ETS1-2 HS-ETS1-3 HS-ETS1-4
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 Engineering**	• What is rapid prototyping? • What are the four basic types of manufacturing? • What is quality control? • What is computer-aided manufacturing? • What is computer-integrated manufacturing? • Why is packaging important to a manufacturer?	• Explain the benefits of rapid prototyping. • Identify four types of manufacturing systems and explain the benefits of each. • Explain how quality control in manufacturing has evolved. • Compare and contrast the roles of computer-aided and computer-integrated manufacturing. • Analyze the role of packaging in the manufacturing process.	• 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 ST 1,6	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards MN-PPD 1,3,4,5	**Math** S-IC.1,4,6
					Science HS-ETS1-4
Weeks 17-19 **Math and Science**	• Why are math and science important in engineering tasks?		• Written Summary • Discovery Project	**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
Connections	• How do engineers use mathematics to measure energy savings and construction costs? • What is the impact of nature on engineering design? • What types of energy should engineers be able to evaluate?	• Explain why math and science are important to the daily tasks of engineers in all disciplines. • Describe the concept of a normal distribution and two ways in which this concept can be applied in engineering. • Describe three levels of mathematics used by engineers. • Describe how probability and statistics affect the choices applied to engineering designs. • List applications of geometry and trigonometry in engineering. • Identify three main physics topics of interest to engineers. • Describe how engineers work within four fields of science.			9-10SL 1,2,3,4,5,6 9-10L 1,2,3,4,5,6
				Cluster Standards ST 4	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-SM 1,4	**Math** A-CED.4 S-ID.4
					Science HS- ESS2-1 HS-PS3-1
Weeks 20-22 **Materials and Fabrications**	• What are the characteristics and classifications of natural and synthetic materials? • How do engineers choose materials 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 engineers choose materials 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	**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 ST 1,2,3	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
				Pathway Standards ST-ET 1,2	**Math** A-CED.4 N-Q.1
					Science HS-ETS1-2 HS-ETS1-3 HS-PS2-6
Weeks 23-25 **Mechanical Engineering**	• What are Newton's laws of motion? • 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?	• Summarize Newton's three laws 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.	• Task Analysis: Engineering Steps Needed for the Development of a Selected Product • Research Report: Product Using Simple Machines • Mechanical Terminology Quiz	**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 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-PS2-1 HS-PS3-1 HS-PS3-2
Weeks 26-27 **Electrical Engineering**	• What is required for licensing of electrical engineers? • How is electricity measured and what terms are used in	• Describe specialty and licensing options of electrical engineers. • Identify at least four measurements (and their units of measure) that are critical to	• Simple Generator Construction • Electrical Terminology Quiz	**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

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
	measuring electricity? • How is electricity generated? • What is the difference between direct and alternating current?	electrical and electronics engineers. • Describe several ways energy is used to create electricity. • Compare direct current and alternating current.	• Performance Test: Calculating and Measuring Volts, Ohms, Amps	**Cluster Standards** ST 2,5 **Pathway Standards** ST-ET 5 ST-SM 1,2,3,4	**Literacy** 9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7 **Math** A-CED.2,4 **Science** HS-PS3-6 HS-PS3-1 HS-PS3-2
Weeks 28-30 **Electronics**	• What is electronics engineering and what are the licensing requirements for electronics engineers? • What is Ohms Law? • What type of equipment and components are used in electronics? • What is a capacitor?	• Explain electronics engineering, educational and licensing 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: Engineering Steps Needed for the Development of a Selected Product • Terminology Quiz • Reading Schematic Drawings Assessment	**Career Ready Practices** CRP 1,2,4,8,11 **Cluster Standards** ST 6 **Pathway Standards** ST-ET 3 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.2,4 **Science** HS-PS3-6
Weeks 31-33 **Air Conditioning and Refrigeration**	• What is air-conditioning and refrigeration? • What is latent heat? • What is sensible heat? • What are conduction, convection and radiation? • What is pressure?	• Compare and contrast air-conditioning and refrigeration. • Explain latent heat. • Explain sensible heat. • Analyze the difference between conduction, convection and radiation. • Explain pressure and the effects of pressure.	• Terminology quiz • Lab Practical	**Career Ready Practices** CRP 1,2,4,8,11 **Cluster Standards** ST 2,6 **Pathway Standards** ST-ET 2,3	**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** HS-PS1-9 HS-PS3-3
Weeks 34-35 **The Engineering Team**	• What other professions are involved with engineers? • What are the ways in which engineers communicate? • Why is communication an integral part of engineering?	• Identify the professionals and team members who work with engineers. • Describe communication skills engineers must develop to work successfully with others. • Examine the additional safety, information technology, cultural, and business skills that are important to the engineer's professional life. • Analyze the need to diversify the engineering workforce.	• Research and Presentations: Professional Qualities Used in the Field of Engineering	**Career Ready Practices** CRP 1,2,4,7,11 **Cluster Standards** ST 5 **Pathway Standards** ST-ET 2,3	**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** HS-ETS1-2 HS-ETS1-3
Weeks 36-39				**Career Ready Practices**	**ELA**

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
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	CRP 1,2,4,8,11,12	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-ETS1-2 HS-ETS1-3
Week 40 **Course Wrap-Up and Evaluation**	• How can I apply what I know in a final project? • What have I learned?	• Apply engineering 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
MET 200: Mechanical Technology 200

Program Overview

The PTECH Mechanical Technology program provides students with the opportunity to learn the fundamentals of engineering toward the goal of earning college credits and an Associate's degree in Mechanical Technology from Onondaga Community College. Students in the Mechanical Technology program 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, computer-aided design and automated manufacturing. 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 engineering 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 engineering concepts, practices and projects introduced in MET 100 and will explore various aspects of the engineering profession. Students will gain additional knowledge about potential career pathways to selected engineering roles. They will work to further develop skills in professional and ethical responsibilities and behaviors. Through their enrollment in MET 150: Introduction to Engineering, students will be introduced to more advanced skills in technical drawing, the use of practical engineering tools, engineering 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, drive systems and hydraulics. Through various work-based experiences, students will continue to study education and licensing requirements, roles and responsibilities, regulatory agencies and work settings for various career pathways within the engineering 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 engineering 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 be connected with working mechanical engineering 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.

Pre-Requisites

MET 100

Course Objectives

By the end of the course students will:

- identify the major disciplines in the engineering field and associated pathways to becoming educated and licensed.
- identify ethical and professional roles and responsibilities of the engineering profession.
- apply teamwork, communication skills research practices to assigned projects.
- learn and apply electrical, hydraulic and drive system concepts.
- learn and apply basic skills in technical drawing and design, CAD and use of practical engineering 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 MET 200, will earn 3 college credits for 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

Quarter	Units of Study
1	• Introduction to Course, Classroom Practices, and Expectations: Being Successful • Roles and Responsibilities of Engineers • Engineering Careers • Use of Practical Measuring Tools • Mechanical and Electrical Engineering • Fundamentals of Electricity
2	• Electrical Circuit Components • Input/Output Devices • Mechanical Drive Systems • Key Fasteners • Power Transmission • Spur Gears and Multiple Shaft Drives
3	• V-Belt and Chain Drives • Introduction to Technical Drawings • Introduction to CAD (Computer Aided Drawing) • Hydraulics
4	• Introduction to Problem Solving Failure Analysis • Simple Machines • Computer Programs • Collecting and Analyzing Data, Statistics • Ethics • Final Project Presentations • Course Wrap-Up and Evaluation

Syracuse City School District
Career and Technical Education Program
Scope and Sequence
MET 200: Mechanical Technology 200

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: Being Successful**	• 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 Engineer**	• What are the roles and responsibilities of engineers? • What are the personal attributes of successful engineers? • What are the legal/ethical responsibilities for engineers? • What does teamwork look like in engineering? • How do U.S. companies manage engineering teams with locations overseas?	• Describe the tasks engineers perform. • Define the duties and obligations of engineers. • Describe the personal attributes to consider when pursuing an engineering career. • Explain the concept of teamwork in businesses employing engineers. • Determine a plan for the management of U.S. based companies with sites abroad.	• Questions for Guest Speaker • Quiz: Roles and Responsibilities of Engineers • Group Projects: Attributes Necessary for Success in Engineering • Teamwork Problem Solving Activity: Strategic Plan for Collaborating with Overseas 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 **Engineering Careers**	• What types of engineering titles exist within the profession? • What is the demand for engineers? • What are the duties of an engineer? • How do legal and ethical concerns impact the public? • What professional organizations and memberships are available to engineers?	• Describe the responsibilities and duties of engineers. • Explain the legal and ethical responsibilities of engineering. • Identify the organizations for engineering professionals. • Explain the need for policies and regulations for the profession.	• Research Project and Presentations: Selected Engineering Careers • Field Trip to Engineering Company • Written Assessment: Roles and Responsibilities in the Profession • Group Activity Rubric: Legal and Ethical Responsibilities in Engineering • Group Activity Rubric: Current Articles and Research in Ethics In Engineering	**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 **Use of Practical Measuring Tools**	• What is the relationship between English and metric linear measurement?	• Convert English to metric linear measurement. • Apply metric measurement to design models.	• 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 9-10SL 1,2,3,4,5,6 9-10L 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
	• What tools are used for measurements in engineering?	• Identify measurement tools used in mechanical and electrical engineering.		**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 Engineering**	• What is a mechanical engineer? • What is an electrical engineer? • How do engineers impact our daily lives? • What are the education and licensing requirements for mechanical and electrical engineers? • Where do mechanical and electrical engineers work?	• Define mechanical engineering. • Define electrical engineering. • Describe the roles and responsibilities of mechanical and electrical engineers. • Explain the education and licensing requirements for mechanical and electrical engineers. • Describe the career paths for mechanical and electrical engineers. • Describe the physical settings and types of companies that employ mechanical and electrical engineers.	• Quiz: Application of Engineering Terminology • Task Analysis: Engineering Steps Needed for the Development of a Selected Product • Research Paper: Mechanical/Electrical Engineering Career Paths, Education, And Degree Required • Field Trip to Engineering 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 magnetism? • What is a resistor and how are resistors measured? • What are volts, amps and resistance? • What are circuits? • What is electricity? • What are the differences between alternating and direct current? • What is engineering notation?	• Explain Ohm's Law. • Identify volts, amps and resistance in electrical theory. • Explain magnetism as it applies to 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 HS-PS 3-6
Weeks 11-12 **Electrical Circuit Components**	• What are the basic components of an Electrical circuit? • What are the types of power supplies? • What is an electrical schematic?	• Describe the function of the four basic components of an electrical circuit. • Describe the operation of two types of power supplies. • Draw a schematic sing the symbols for circuit components.	• Electrical Terminology Quiz • Performance Quiz: Calculating and Measuring Volts, Ohms, Amps • Troubleshooting a Simple Circuit	**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	**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 HS-ETS 1-3
Weeks 13-14	• What are manual input devices?	• Identify each manual input device. • Explain the difference between NO and	• Performance Task: Construct 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

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
Input/Output Devices	• What is the meaning of NO and NC? • What are three manual input devices? • Why do engineers use electrical schematic drawings for manual input devices?	NC. • Draw an electrical schematic and legend. • Construct a circuit using input and output device by reading a schematic.	• Troubleshooting a Simple Circuit		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 HS-ETS 1-3
Week 15 **Mechanical Drive Systems**	• 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?	• 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.	• Performance Evaluations • Application of Safety Rules in Practical Situations • Quiz/Test • Individual Projects: Constructing a Functioning Simple Machine	**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 MN-HSE 1	**Math** A-CED.4 F-IF.6
					Science HS-PS 3-3 HS-ETS 1-2 HS-ETS 1-3
Week 16 **Key Fasteners**	• 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?	• Identify and apply different types of fasteners. • Identify and give an example of keys and keyseats. • Measure and cut a key from stock. • Assemble a motor coupling. • Calculate mechanical efficiency.	• Vocabulary of Fasteners Terms Assignment • Lab Practicals • Worksheets • 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 MN-HSE 1	**Math** S-IC.4 A-CED.4
					Science HS-PS 3-3
Weeks 17-18 **Power Transmission**	• 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 loaded? • What are the types and functions of couplings?	• Explain the function of a shaft and identify shaft sizes from samples. • Categorize bearings from a sample. • Install a motor shaft and bearing assembly. • Recognize where and when to use a coupling. • Problem-solve shaft alignment and misalignment. • Demonstrate the use of measuring devices in shaft alignment.	• Vocabulary Assignment • Worksheets • Unit Exam • Performance Evaluation	**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	**Math** A-CED.4 F-IF.4 A-REI.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
					Science HS-ETS 1-2 HS-ETS 1-3
Weeks 19-20 **Spur Gears and Multiple Shaft Drives**	• 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?	• 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.	• Vocabulary Assignment • Research Project: Application of a Gear Drive System • Worksheets • Unit Exam • Performance Evaluation	**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-SM 1	**Math** A-REI.1 A-CED.2,4 F-IF.6 F-TF.1
					Science HS-PS2-1
Weeks 21-22 **V-Belt and Chain Drives**	• 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?	• Identify belt and chain types. • Identify the basic components of a belt or chain drive system. • Measure and size V-belt.	• Vocabulary of Belt and Chain Drives Worksheets • Quizzes • Unit Exam • Performance Evaluation	**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-SM 1	**Math** A-REI.1 A-CED.2,4 F-IF.6 F-TF.1 N-Q.1
					Science
Weeks 23-25 **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-PS3-1
Weeks 26-27 **Introduction to CAD (Computer Aided Drawing)**	• What is CAD? • What are some different types of CAD applications?	• Describe essential drawing tools in CAD. • Apply CAD drawing applications to basic designs.	• Quiz on Terminology • Written Critique: Pros and Cons of CAD	**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

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
	• What is important to consider in using CAD?	• Differentiate between CAD and other drawing tools.	• Application of CAD Software in Project Design	**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-PS3-1
Weeks 28-29 **Hydraulics**	• What is fluid power? • Why are hydraulics used? • What are Pascal's laws? • What is viscosity?	• Describe hydraulics. • Explain the principles of hydraulics. • List and explain the components used in a hydraulic system. • Utilize the principles of Pascal's Laws. • Explain viscosity.	• Lesson Review Sheets • Component Identification Worksheet	**Career Ready Practices** CRP 1,2,4,8,9	**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 1,2,3	**Math** A-CED.4 A-REI.1 G-GMD.3,4 G-MG.2,3
					Science HS-PS2-6
Weeks 30-32 **Introduction to Problem Solving Failure Analysis**	• What is the importance of problem-solving and how do engineers apply problem-solving skills? • Why is failure analysis important to engineers and what is its impact? • What is Rapid Root Cause Analysis (RRCA)? • How is data analysis applied to failure analysis?	• Explain the application of problem solving to the design process. • Analyze and troubleshoot designs. • Analyze structural integrity. • Explain why structures fail. • Explain Rapid Root Cause Analysis (RRCA). • Describe how data analysis is applied to failure analysis.	• 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-ETS1-2 HS-ETS1-3
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 HS-PS3-3

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
					HS-PS2-1 HS-ETS1-2 HS-ETS1-3
Week 35 **Computer Programs**	• What are the common programs used in engineering? • How have programs improved today's production processes?	• Compare and contrast traditional technical drawing and CAD. • Explain how computer engineering software aids in the production process.	• Application of Engineering 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-ETS1-2 HS-ETS1-3
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 engineers? • 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 engineers? • What are the results of non-ethical practices?	• Explain how engineering 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-ETS1-1
Weeks 38-39 **Final Project Presentations**	• How can I apply what I know in a final project?	• Apply engineering 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**
				Cluster Standards ST 6	**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
				Pathway Standards	**Literacy**

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
				ST-ET 5	9-10RST 1,2,4,7,8,9 9-10WHST 2,5,6,7
					Math
					Science HS-ETS1-2 HS-ETS1-3
Week 40 **Course Wrap-Up and Evaluation**	• How can I apply what I know in a final project? • What have I learned?	• Apply engineering 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
MET 300: Mechanical Technology 300

Program Overview

The PTECH Mechanical Technology program provides students with the opportunity to learn the fundamentals of engineering toward the goal of earning college credits and an Associate's degree in Mechanical Technology from Onondaga Community College. Students in the Mechanical Technology program 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, computer-aided design and automated manufacturing. 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 engineering 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 technology in society and learn and apply skills in digital and information technologies, concepts, and terminologies. Students will demonstrate the skills needed to be an informed digital citizen, achieve academic and workplace success, and participate in an increasingly globalized environment. Students will use web applications, word-processing, spreadsheet, database, presentation, and other software to learn, search and organize their research, and then present and communicate their findings. Students will also learn the necessary skills to interpret and construct engineering 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 engineering 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 be connected with working mechanical engineering 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.

Pre-Requisites

MET 100, MET 200, Regents Math

Course Objectives

Students will:

- Demonstrate the ability to use appropriate digital tools and software to organize, analyze and present information in a variety of structures.
- Apply basic skills, search techniques, and research methodologies in authentic situations.
- Manipulate operating systems and application programs.
- Organize files and folders on a computer, and make use of network storage resources and other cloud-based services.
- Interpret and construct engineering 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.

Integrated Academics

1 CTE Integrated Science Credit

Concurrent Enrollment College Credit

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

- CIS 100: Computer and Information Literacy
- 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, F. E., Mitchell, A. E., Spencer, H. C., Dygdon, J. T., Hill, I. L., Novak, J. E., Loving, R. O., Lockhart, S. E. Johnson, C. (2016). *Technical Drawing with Engineering Graphics 15th Edition.* Hoboken, NJ: Peachpit Press.

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

Parsons, J. J., Oja, D., Beskeen, D. W., Cram, C. M., & Duffy, J. (2012). *Computer Concepts and Microsoft Office 2010 Illustrated.* Boston: Cengage.

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

Quarter	Units of Study

1 and 2	• Classroom Practices: Being Successful
	• Personal and Professional Characteristics in Mechanical Technology
	• Workplace Safety: OSHA 10 Certification
	• CIS 100: Computer and Information Literacy
	  ○ Society, Digital Citizenship and Ethical Computing
	  ○ Safe Use of the Internet, Social Media, and other Digital Tools
	  ○ File Management, Storage and Backups
	  ○ Word Processing and Microsoft Word
	  ○ Presentation Software and Microsoft PowerPoint
	  ○ Technical Reports and PowerPoint Presentations
	  ○ Spreadsheets and Microsoft Excel
	  ○ Inputting and Modifying Data, Basic Formatting and Formulas
	  ○ Using Averages, Percent Weighting, and IF Statements
	  ○ Percent Error, Elementary Statistics, and Plotting Data Results
	  ○ Formulas and Plots in Excel
	• MET 161: Engineering Drawing
	• Work-Based Learning: Career Coaching, Job Shadowing

3 and 4	• CIS 100: Computer and Information Literacy
	  ○ Conversions and Calculation
	  ○ Engineering Lists and Historical Logs
	  ○ Intermediate Formulas and Mechanical Analysis in Excel
	  ○ Product Proposals and Marketing
	  ○ Advanced Statistics and Data Analysis in Excel
	  ○ Engineering Functions in Excel
	  ○ Curve Fitting and Plotting in Excel
	  ○ Tables and Selecting Data for Engineering Calculation
	• 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
MET 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 engineer? • What are the professional characteristics necessary for success in the engineering 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 engineer 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 emergency stops and deadman switches.	• 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**
		• Explain how to interact safely with work envelopes including assessing risks associated with the movements of machine and automated components. • Pursue OSHA 10 certification.			
CIS 100: Computer and Information Literacy **Society, Digital Citizenship and Ethical Computing**	• What is the impact of digital technologies on society? • What does it mean to be a good digital citizen? • What is the proper use of social media? • How can technology be used ethically to avoid hurting others and oneself? • How can information be verified as accurate and true? • Should outdated technology equipment be recycled?	• Summarize the historical development of digital technologies and ascent of the internet. • Describe how digital technologies are used and influence various aspects of society and workforce environments. • Explain the concept of digital divide and propose ethically and socially responsible solutions. • Demonstrate professionalism while exchanging their ideas and interests over the internet or through social media. • Describe the potential risks to personal privacy and security posed by current and emerging technologies, and identify ways to minimize and mitigate these risks. • Identify positive social and ethical behaviors when using digital technologies and the likely consequences and penalties for misuse or misapplication. • Explain and abide by Intellectual Property (IP), Copyright, Creative Commons (CC), and Fair Use principles.	• Research Project • Tests and Quizzes • Self-Assessment • Professional Portfolio	**Career Ready Practices** CRP 1,2,4,7,8,9,11 **Cluster Standards** ST 3,4 **Pathway Standards** ST-ET 2,3 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**
CIS 100: Computer and Information Literacy **Safe Use of the Internet, Social Media, and other Digital Tools**	• How can the internet be dangerous? • What can users do to protect themselves? • What are the pros and cons of social media? • What can users do to avoid negative experiences with social media? • What other digital tools are there and how can they be used in healthy ways?	• Describe some possible dangers in using the internet. • Explain ways that internet users can protect themselves from possible online dangers. • Describe the pros and cons of social media. • Identify ways to avoid negative experiences with social media. • List other digital tools and explain how they can be used in healthy ways. • Perform information searches using specialized internet resources, including online library resources, online journals, multimedia, and conventional databases and evaluate sources of information for use in research and publication.	• Tests and Quizzes • Self-Assessment • Professional Portfolio	**Career Ready Practices** CRP 1,2,3,4,8,11 **Cluster Standards** ST 3,4 **Pathway Standards** ST-ET 2,3 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**

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**
		• Apply basic skills, search techniques, and research methodologies in authentic situations. • Recognize the limits and risks associated with virtual, cloud-based services. • Participate in emerging new media including online discussion forums, blogs, and social media. • Identify the functions of the protocols utilized to communicate, collaborate, and retrieve information on the internet. • Describe when it is appropriate to use secure internet services and how to recognize when accessing them.			
CIS 100: Computer and Information Literacy **File Management, Storage and Backups**	• What is a drive and what are the different types? • What are files and file extensions? • What are the most important file types and what do they do? • How is data transferred, shared, and backed up? • How is data protected from loss, damage, or attack? • How is data restored?	• Define and explain the function of different types of drives, including hard drives, network drives, cloud drives, internal and external drives, and thumb drives. • Describe programs and methods for navigating drives, folders, and files on a computer. • Explain the importance of folder creation in order to keep files organized and easy to find. • Explain how data is transferred and shared. • Explain how data is protected from loss, damage, or attack. • Explain how data is restored.	• Tests and Quizzes • Self-Assessment • Professional Portfolio	**Career Ready Practices** CRP 1,2,4,8,11 **Cluster Standards** ST 6 **Pathway Standards** ST-ET 2,3 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**
CIS 100: Computer and Information Literacy **Word Processing and Microsoft Word**	• What is word processing and what is it used for? • How are documents edited for errors? • What types of professional documents can be created? • How are documents manipulated to improve the professional appearance?	• Explain the importance of word processing. • Use keyboarding skills to create word processing documents. • Navigate, highlight, format and edit word processing documents. • Use document templates to create commonly used text documents. • Create resumes, memos, business letters, and other professional documents.	• Tests and Quizzes • Self-Assessment • Professional Portfolio	**Career Ready Practices** CRP 1,2,4,8,11 **Cluster Standards** ST 6 **Pathway Standards** ST-ET 2,3 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**
CIS 100: Computer and Information Literacy **Presentation Software and**	• What is a presentation and what is its purpose? • What makes an effective presentation? • What tools can be used to improve the appearance and	• Explain what a presentation is and what it is used for. • Describe the qualities of an effective presentation.	• Tests and Quizzes • Self-Assessment • Professional Portfolio	**Career Ready Practices** CRP 1,2,4,8,11 **Cluster Standards** ST6	**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

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**
Microsoft PowerPoint	effectiveness of a presentation? • What can be done to deliver a presentation in a way that engages and informs the audience?	• Explain how to deliver a presentation that will engage and inform people about the subject.			11-12WHST 2,5,6,7
				Pathway Standards ST-ET 2,3 ST-SM 1,2,4	**Math** **Science**
CIS 100: Computer and Information Literacy **Technical Reports and PowerPoint Presentations**	• How can advanced skills in Microsoft Office programs save time? • What are important attributes of a good public speaker?	• Demonstrate use of title page templates. • Create an auto updating table of contents, citations, and bibliography in Microsoft Word. • Create and present a PowerPoint presentation on selected subject.	• PowerPoint Presentations • Self-Assessment • Technical Reports • List of Works Cited In MLA or APA Style	**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 ST 6	**Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7
				Pathway Standards ST-ET 2,3 ST-SM 1,2,4	**Math** **Science**
CIS 100: Computer and Information Literacy **Spreadsheets and Microsoft Excel**	• What is a spreadsheet and what is its purpose? • What makes an effective spreadsheet? • What tools can be used to share data and information from a spreadsheet?	• Describe what a spreadsheet is and what it can be used for. • Explain the different parts of a spreadsheet. • Create a spreadsheet and add data. • Perform basic calculations using spreadsheet formulas. • Sort and filter data. • Create visual representations of spreadsheet data. • Explain the relationship between spreadsheets and databases.	• Tests and Quizzes • Self-Assessment • Professional Portfolio	**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 ST6	**Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7
				Pathway Standards ST-ET 2,3 ST-SM 1,2,4	**Math** **Science**
CIS 100: Computer and Information Literacy **Inputting and Modifying Data, Basic Formatting and Formulas**	• How are percentages converted to decimals? • How can unit conversion be important to engineers utilizing complex equations in calculations? • In what ways does a graphical plot assist data or engineering analysts perform tasks more effectively?	• Utilize basic math calculations and percentages in Excel. • Create linear equation plots. • Explore Excel as it applies to data and chart plotting. • Plot results as a graphical representation. • Explain how data analysis affects the choices applied to engineered designs or processes.	• Formatting Assignments • Lab: Assigned Application Projects • Submission to Office 365 One Note	**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 ST 6	**Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7
				Pathway Standards ST-ET 2,3 ST-SM 1,2,4	**Math** **Science**
CIS 100: Computer and Information Literacy **Using Averages, Percent Weighting, and IF Statements**	• How are averages calculated? • How can percentages be used to weight data? • What is the purpose or benefit of organized data tables, summary tables, and auto updating formulas?	• Create formulas for average and weighted final average. • Utilize IF statements to return a text string from a conditional formula. • Input information into organized Excel spreadsheet. • Identify and use shortcut keys, Excel	• Project/Lab: Functions and Tools • Cloud Computing Assignment • Summary: Use of Electronic Data Analysis	**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 ST 6	**Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7

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**
	• How is an Excel template useful for engineers who frequently perform similar data analyses?	tools, ribbon functions. • Describe the advantages of using templates for analyzing data in daily engineering operations.		**Pathway Standards** ST-ET 2,3 ST-SM 1,2,4	**Math** **Science**
CIS 100: Computer and Information Literacy **Percent Error, Elementary Statistics and Plotting Data Results**	• What is a histogram? • What is percent error used for? • What is the difference between SORT and FILTER in Excel? • Why is data analysis important in engineering and industry?	• Generate simple experimental data. • Examine error or differences between theoretical and experimental data. • Utilize Excel to SORT results, generate a scatter plot and a frequency histogram plot.	• Project/Lab: Application of Excel Functions to Assigned Documents • Vocabulary Quiz	**Career Ready Practices** CRP 1,2,4,8,11 **Cluster Standards** ST 6 **Pathway Standards** ST-ET 2,3 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**
CIS 100: Computer and Information Literacy **Formulas and Plots in Excel**	• What is amortization plotting used for? • How could a loan payment schedule be important to manufacturing facilities? • How could amortization plotting be used to finance a purchase?	• Explain the variables of an amortization plot and generate loan payment schedules. • Assess and analyze data. • Use and apply math formulas to analyze data tables in Excel.	• Project/Lab: Application of Assigned Formulas and Plotting Activities • Terminology Quiz	**Career Ready Practices** CRP 1,2,4,8,11 **Cluster Standards** ST 6 **Pathway Standards** ST-ET 2,3 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 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 engineering drawings? • How are engineering 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 engineering drawings dimensioned? • How are engineering drawings that utilize geometric dimensioning and	• Explain the alphabet of lines. • Explain and demonstrate the are used for sketching and lettering in technical drawing. • Utilize appropriate drawing instruments in engineering drawings. • Interpret engineering drawings. • Construct multi-view drawings utilizing orthographic principles. • Construct sectional views. • Produce assembly drawings from working drawings. • Dimension basic engineering drawings. • Analyze engineering 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 **Cluster Standards** MN 6 ST 6 **Pathway Standards** ST-ET 1,2,3,5,6 ST-SM 1,2,3,4	**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**
	tolerancing principles analyzed?				
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**
CIS 100: Computer and Information Literacy **Conversions and Calculation**	• How can Excel be used as a quick unit conversion calculator? • What are common equations that utilize unit conversion?	• Perform fundamental unit conversion and utilize Excel for basic multivariable calculations. • Identify where unit conversion is required or necessary. • Formulate a plan to convert units using Excel application.	• Project/Lab: Conversions and Calculations • Word Problem and Unit Conversion Assignments	**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 ST 6	**Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7
				Pathway Standards ST-ET 2,3 ST-SM 1,2,4	**Math** A-CED.4 N-Q1
					Science HS-PS2-1 HS-PS3-5 HS-PS3-6
CIS 100: Computer and Information Literacy **Engineering Lists and Historical Logs**	• What is the purpose of an engineering log template? • Why would a manufacturing facility need an Approved Vendor List? • What issues would occur if products are designed and built without a proper Bill of Materials? • How could an engineer be more effective using a Lessons Learned Log?	• Apply key terms and engineering vernacular. • Create important engineering lists and historical data logs commonly created in industry. • Retrieve important information from engineering databases. • Utilize the FILTER and FREEZE PANES tools in Excel.	• Creation of Excel Database • Project/Lab: Application of Excel Functions and Tools • Terminology Quiz	**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 ST 6	**Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7
				Pathway Standards ST-ET 2,3 ST-SM 1,2,4	**Math**
					Science HS-ETS 1-3 HS-ETS 1-4
CIS 100: Computer and Information Literacy **Intermediate Formulas and Mechanical Analysis in Excel**	• What is a spring constant? • Why are material selections important to engineers during the design process? • What is oscillation? • What is resonance and how could it be catastrophic to engineering design? • What is a dampening system? • How can civil engineers use calculations in project design to prevent structural damage?	• Mathematically model spring constant data. • Analyze critical information for solution of the model. • Solve for the differential equation variables provided. • Explain how civil engineers use calculations in project design.	• Application of Intermediate Formulas in Excel • Project/Lab with Write Up and Excel Plots • Analysis of Mechanical Data Using Excel • Terminology Quiz	**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 ST 6	**Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7
				Pathway Standards ST-ET 2,3 ST-SM 1,2,4	**Math** A-SSE.1
					Science HS-PS2-1
CIS 100: Computer and Information Literacy **Product**	• What is included in an engineer's Career Profile? • What is the difference between technical and commercial proposals?	• Create an all-inclusive career profile. • Develop a technical product proposal. • Compare the difference between technical and commercial information.	• Presentations of Product Proposals • Self-Evaluation • Development of Career Profiles	**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	**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**
Proposals and Marketing	• Why does a company that manufactures engineered products provide customers with a technical product proposal?			ST 6 **Pathway Standards** ST-ET 2,3 ST-SM 1,2,4	11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7 **Math** **Science** HS-ETS 1-3
CIS 100: Computer and Information Literacy **Advanced Statistics and Data Analysis in Excel**	• What is regression analysis used for? • What is P Value? • What is a significant indicator? • What is the difference between overhead (fixed) costs and variable costs?	• Model, develop, interpret, and evaluate regression analysis of actual industry data. • Calculate and predict future electrical consumption in a manufacturing facility.	• Project/Lab: Advanced Concepts/Functions in Excel • Electrical Consumption Analysis of Manufacturing Facility with Empirical Data	**Career Ready Practices** CRP 1,2,4,8,11 **Cluster Standards** ST 6 **Pathway Standards** ST-ET 2,3 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** N-Q.3 S-IC.2 S-ID.1,2,4 **Science** HS-ETS 1-3 HS-ETS 1-4
CIS 100: Computer and Information Literacy **Engineering Functions in Excel**	• What is a Bessel Function? • What is the VLOOKUP function used for? • How is normalization used in data analysis?	• Build tables in Excel utilizing the BESSEL function. • Perform a VLOOKUP of data. • Develop plots after normalizing data sets.	• Project/Lab with Write Up and Excel Plots	**Career Ready Practice** CRP 1,2,4,8,11 **Cluster Standards** ST 6 **Pathway Standards** ST-ET 2,3 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** S-ID.4 S-CP.1 **Science**
CIS 100: Computer and Information Literacy **Curve Fitting and Plotting in Excel**	• What is array curve fitting used for? • What is a 2nd order polynomial equation? • What are the slope and y-intercept variables in a linear equation?	• Identify the difference between linear and non-linear equations. • Create a best fit equation for differing order equations. • Utilize the LINEST function in Excel.	• Project/Lab with Write Up and Excel Plots • Applied Engineering Math Assignments	**Career Ready Practice** CRP 1,2,4,8,11 **Cluster Standards** ST 6 **Pathway Standards** ST-ET 2,3 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** A-CED.2 F-LE.1,2,5 **Science** HS-PS3-5
CIS 100: Computer and Information Literacy	• Where do reference tables come from? • Why would engineers use	• Read and pull critical information from reference tables. • Solve for missing reference information	• Quiz: Excel Functions • Project/Lab Skill Application	**Career Ready Practices** CRP 1,2,4,5,6,8,9,11	**ELA** 11-12R 1,2,4,7,8,9 11-12W 2,5,6,7 11-12SL 1,2,3,4,5,6

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**
Tables and Selecting Data for Engineering Calculation	reference tables? • What information is found on Steam Tables?	using interpolation. • Explain the importance of engineering reference tables.	• Extracting Important Data from Text Strings of Raw Unfiltered Data	**Cluster Standards** ST 6 **Pathway Standards** ST-ET 2,3 ST-SM 1,2,4	11-12L 1,2,3,4,5,6 **Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7 **Math** N-Q.1 **Science** HS-PS1-9
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**

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 **Materials and Layout**	• What are four types of manufacturing materials and how are they used? • What are the physical, mechanical and chemical 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?	• Identify four types of manufacturing materials and their common uses in manufacturing processes. • Define physical, mechanical and chemical properties. • 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.	• 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 **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?	• 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.	• 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 causes of operating errors determined? • 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?	• Explain the importance of conducting tests and inspections of products, services or 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	**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.		ST-SM 1,2,4	
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? • What are common problems and solutions in surface grinding?	• 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. • Describe common problems and solutions in surface grinding.	• 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 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 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
MET 400: Mechanical Technology 400

Program Overview

The PTECH Mechanical Technology program provides students with the opportunity to learn the fundamentals of engineering toward the goal of earning college credits and an Associate's degree in Mechanical Technology from Onondaga Community College. Students in the Mechanical Technology program 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, computer-aided design and automated manufacturing. 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 engineering 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. 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 engineering nomenclature within the context of their projects. Students will also participate in field-based internships where they will work with industry professionals to apply engineering 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 be connected with working mechanical engineering 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.

Pre-Requisites

MET 100, MET 200, MET 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 engineering 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
1 CTE Integrated ELA Credit

Concurrent Enrollment College Credit

Upon successful completion of MET 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

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

Syracuse City School District
Career and Technical Education Program
Scope and Sequence
MET 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 engineer? • What are the professional characteristics necessary for success in the engineering 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 engineer 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**

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**
Independent Senior Project #1	• 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 **Cluster Standards** MN 6 ST 1,2,3,6 **Pathway Standards** MN-PRO 5 ST-ET 1,2,3,4,5,6 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**
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 **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 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. • Explain and demonstrate EDM (Electrical Discharge Machining).	• 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**

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 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**
Senior Project #2	• 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 **Cluster Standards** MN 6 ST 1,2,3,6 **Pathway Standards** MN-PRO 5 ST-ET 1,2,3,4,5,6 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**
Work-Based Learning: **Internship**	• How does an employee convey professionalism in the workplace?	• Apply job search techniques to seek out, evaluate and obtain internship opportunities. • Communicate with industry/potential employers through the internship experience.	• Self-Assessment • Reflection Summary: Internship Experience • Professional Portfolio	**Career Ready Practices** CRP 1,2,4,6,8,10,11,12	**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

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**
	• 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 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.	• Employability Profile • Internship Checklist • Employer/Mentor Observation Checklist	**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	**Literacy** 11-12RST 1,2,4,7,8,9 11-12WHST 2,5,6,7 **Math** **Science**