Syracuse City School District
Career and Technical Education
Course Syllabus
PTP 100: PTECH Pre-Engineering 100

Program Overview
Students will develop critical and analytical thinking, troubleshooting and problem solving skills through hands-on activities in this project-based curriculum. Electrical and mechanical concepts and processes are taught and topics include ethics in engineering, technical drawing and cad design, measuring tools, simple machines, failure analysis, and data collection and analysis. Career pathways are explored and skills are enhanced through work-based experiences. The PTECH program offers the opportunity to earn college credits toward Electrical Engineering or Mechanical Technology degrees. Upon completion of PTP 100-300, students will earn 11th grade science credit, and following the successful completion of PTP 100-400, students will be awarded specialized math and 12th grade ELA credits.

Course Description
This course will provide an overview of various aspects of the engineering profession. Students will gain skills in career exploration, learn more about pathways to selected engineering careers and begin to develop foundation skills in professional and ethical responsibilities. Students will learn about practical engineering tools, engineering design and the basics of CAD and CAM, air conditioning and refrigeration. Through various speakers and field trip experiences, they will learn about education and licensing requirements, roles and responsibilities, regulatory agencies and work settings. Students will also begin to learn and apply standard engineering nomenclature within the context of the subjects, and based on instruction and research, they will begin to understand the need for industry regulations and protocols. In addition, they will practice team building, critical thinking skills, oral and written communications.

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

Equipment and Supplies
School will provide:
• Computer hardware and software
• Engineering and drawing tools and measurement instruments.
• Plotter/printer
Student will provide:
• 3-Ring Binder
• Dividers
• Writing utensils – pens and pencils
• Notebook and filler paper

Textbook
TBD

Grading

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<td>• Air Conditioning and Refrigeration Characteristics</td>
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| Week 1-2 Introductions and Classroom Procedures | • Who are you?  
• What do you think this course is about?  
• What procedures and safety practices will be important in this class?  
• What does respect and leadership mean? | • Understand and engage in icebreaker and "getting to know you" exercises  
• Explain the rationale for and follow classroom rules and procedures  
• State and apply safety rules and procedures for the class and school  
• Discuss classroom respect and leadership | • Students will learn about other students and staff  
• Safety quiz  
• Compliance with procedures  
• Posters with Presentations | Career Ready Practice  
CRP1,4  
Cluster Standards  
ST3  
Pathway Standards  
ST-ET2 | Literacy  
RST.9-10.1,3  
WHST.9-10.4  
ELA  
R.9-10.2,7  
W.9-10 2,4,6  
SL.9-10.1,4  
L.9-10.1  
Math  
Science  
HS-ETS1-2  
HS-ETS1-3 |
| Week 3-4 Introduction to Technology and Engineering | • What is the definition of engineering?  
• What are the connections among science, technology, engineering, and mathematics?  
• Can you name early examples of engineering and models of great engineering achievements of the past century?  
• How would you compare major engineering activities? | • 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 | • Quiz on engineering terms  
• Research and write papers on engineering achievements of the past  
• Research assignment on benefits of the engineering profession  
• Student developed questions for guest speaker – 21st Century Rubric | Career Ready Practice  
CRP2,4,7,11  
Cluster Standards  
ST4  
Pathway Standards  
ST-ET2 | Literacy  
RST.9-10.1,2  
WHST.9-10.4,7  
ELA  
W.9-10 .1,2,4,6, 7  
R.9-10.1,2,4,8  
L.9-10.1,2,3,4  
Math  
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HS-ETS1-2  
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<th>Key Learning Targets (Students will know and be able to)</th>
<th>Assessment Evidence of Learning</th>
<th>Related Standards</th>
<th>CCLS Literacy, Math, Science</th>
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<tr>
<td>Week 5-7</td>
<td>• 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? • What is brainstorming?</td>
<td>• Outline and describe the engineering design process • List steps in common design process • Identify engineering problems and opportunities • Describe the rationale for detailed documentation • Discuss design constraints • Identify types of research involved in developing a project • Explain prototyping and rapid prototyping</td>
<td>• Design project presentations. (Rubric) • Quiz, Tests • PBL project</td>
<td>Career Ready Practice CRP1,2,4,7,8,11,12</td>
<td>Literacy RST.9-10.1,2,7 WHST.9-10.4,7</td>
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<td>Cluster Standards ST1,2,6</td>
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<td>Pathway Standards ST-ET2,5</td>
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<td>Week 8-10</td>
<td>• Why is sketching an important part of engineering, and 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-</td>
<td>• 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</td>
<td>• Students will apply techniques learned to a design project involving sketches, drawings, and prototyping • Quizzes • Project completion and assessment (Rubric)</td>
<td>Career Ready Practice CRP2,4,8</td>
<td>Literacy RST.9-10.1,2,7 WHST.9-10.4,7</td>
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<td>Pathway Standards ST-ET1,3,4 ST-SM4</td>
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**Career Ready Practice**
- CRP1,2,4,7,8,11,12

**Cluster Standards**
- ST1,2,6

**Pathway Standards**
- ST-ET2,5

**Literacy**
- RST.9-10.1,2,7
- WHST.9-10.4,7

**ELA**
- R 9-10.1,2,4,7
- W 9-10.1,3,6
- SL 9-10.1,4
- L 9-10.1,3,4

**Math**
- G SRT 5, 6, 8
- G-MG-1, 3
- G-GMD.4
- N-Q.1

**Science**
- HS-ETS1-2
- HS-ETS1-3

**Cluster Standards**
- ST6

**Pathway Standards**
- ST-ET1,3,4
- ST-SM4

**Literacy**
- RST.9-10.1,2,7
- WHST.9-10.4,7

**ELA**
- R 9-10.4
- W 9-10.1,2,4
- SL 9-10.5
- L 9-10.1,4,6

**Math**
- G SRT 5, 6, 8
- G SRT 5, 6, 8
- G-GMD.4
- N-Q.1
- S-IC.4
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| Week 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 | • Application of measurement terminology quiz  
• Assessment on drawing dimensions  
• Performance assessment on use of measuring tools | Career Ready Practice  
CRP2,4,8 | Science  
HS-ETS1-2  
HS-ETS1-3  
HS-ETS1-4 |
| | | | | Cluster Standards  
ST4,6 | Literacy  
RST.9-10.1,2 |
| | | | | Pathway Standards  
ST-SM1,4 | ELA  
R 9-10.1,2,4,7  
W 9-10.2,8  
SL 9-10.1  
L 9-10.6 |
| | | | | | Math  
G-MG.1,3  
N-Q.3  
S-IC.4 |
| | | | | | Science |
| Week 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 | • Discuss 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 manufacturing and computer-integrated manufacturing | • Terminology quiz  
• Students will complete a packaging challenge  
• Exercise to analyze quality issues in a product | Career Ready Practice  
CRP2,4,8,11,12 | Literacy  
RST.9-10.1,2,4 |
| | | | | Cluster Standards  
MN6  
ST1,6 | ELA  
R 9-10.1,3,4,7  
W 9-10.1,8  
SL 9-10.1,2  
L 9-10.1,6 |
| | | | | Pathway Standards  
MN-MIR1  
MN-PPD1,3,4,5  
MN-QA6,7 | Math  
S-IC.1,4,6 |
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<td>Week 17-19</td>
<td>manufacturer?</td>
<td>• Analyze the role of packaging in the manufacturing process</td>
<td>• Written summary to check for understanding</td>
<td>Career Ready Practice CRP1,2,4,8</td>
<td>Science HS-ETS1-4</td>
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<td>Math and Science Connections</td>
<td>• Why are math and science important in engineering tasks? • How do engineers use mathematics to measure energy savings and construction costs? • Do you think that nature and living creatures, even tiny ones like bugs and spiders, can have an impact on engineering design? • What types of energy should engineers be able to evaluate?</td>
<td>• 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 • Discuss 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</td>
<td>Cluster Standards ST-4 Pathway Standards ST-SM1,4</td>
<td>Literacy RST.9-10.1</td>
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<td>Week 20-22</td>
<td>• What are the characteristics and classifications of natural and synthetic materials? • How do engineers choose materials for a</td>
<td>• Identify the characteristics used to classify and group both natural and synthetic materials • Evaluate how engineers choose materials for a</td>
<td>Students will assess material types through various testing procedures • Terminology Exam</td>
<td>Career Ready Practice CRP1,2,4,8,12</td>
<td>ELA R 9-10.2,4 W 9-10.1,8 SL 9-10.1,2,3,4,5 L 9-10.1,2,4,6</td>
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<td>Science HS-ESS2-1 HS-PS3-1</td>
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| Week 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  
• Discuss simple machines  
• Identify five different types of motion.  
• Analyze the purpose of basic mechanisms | • Task analysis of the engineering steps needed for the development of a selected product (Rubric)  
• Research a product that uses simple machines, including a description of each machine in reports  
• Mechanical terminology quiz | Career Ready Practice  
CRP2,4,8,11 | Literacy  
RST.9-10.1,2,4,7 |
| | | | | | | Science  
HS-ETS1-2  
HS-ETS1-3  
HS-PS2-6 |
| | Mechanical Engineering | | | Pathway Standards  
MN-MIR1  
ST-ET1,2 | | ELA  
R 9-10.4,7  
W 9-10.1,5,7  
SL 9-10.1,4  
L 9-10.1,2,6 |
| | | | | | | Math  
A-CED.4  
N-Q.1 |
| | | | | | | Science  
HS-ETS1-2  
HS-ETS1-3  
HS-PS2-6 |
| Week 26-27| Electrical Engineering | • What is required for licensure of electrical engineers?  
• How is electricity | • Discuss specialty and licensure options of electrical engineers.  
• Identify at least four | | Career Ready Practice  
CRP1,2,4,6,8,11,12 | Literacy  
RST.9-10.1,2,4,7 |
| | | | | | | Math  
A-CED.4  
N-Q.1 |
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HS-PS2-1  
HS-PS3-1  
HS-PS3-2 |
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<td>Week 28-30</td>
<td>measured and what terms are used in measuring electricity? • How is electricity generated? • What is the difference between direct and alternating current?</td>
<td>measurements (and their units of measure) that are critical to electrical and electronics engineers • Describe several ways energy is used to create electricity • Compare direct current and alternating current</td>
<td>terminology quiz • Performance test on calculating and measuring volts, ohms, amps</td>
<td>Cluster Standards ST2,5</td>
<td>ELA</td>
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<td>Electronics</td>
<td>What is Electronics Engineering and what are the licensure requirements for electronics engineers? • What is Ohms Law? • What type of equipment and components are used in electronics? • What is a capacitor?</td>
<td>Discuss electronics engineering, educational and licensure 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</td>
<td>Task analysis of the engineering steps needed for the development of a selected product. (Rubric) • Terminology quiz • Assessment on reading schematic drawings</td>
<td>Career Ready Practice CRP2,4,8,11</td>
<td>Literacy RST.9-10.1,3</td>
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<td>Week 31-33</td>
<td>What is air-conditioning and refrigeration? • What is latent heat? • What is sensible heat? • What are conduction, convection and radiation? • What is pressure?</td>
<td>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</td>
<td>Terminology quiz • Lab Practical</td>
<td>Career Ready Practice CRP2,4,8,11</td>
<td>Literacy RST.9-10.1,2,4</td>
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<td>Week 34-35</td>
<td>• What other professions are involved with engineers? • What are the ways in which engineers communicate? • Why is communication an integral part of engineering?</td>
<td>• Identify the professionals and team members who work with engineers • Discuss 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 working life • Analyze the need to diversify the engineering workforce</td>
<td>• Research and present on professional qualities used in the field of engineering</td>
<td>Career Ready Practice CRP1,2,4,7,11</td>
<td>Literacy RST.9-10.1,2,4,7 WHST.9-10.2,4,7</td>
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<td>Pathway Standards</td>
<td>Math Science HS-ETS1-2 HS-ETS1-3</td>
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<td>Week 36-39</td>
<td>• How can I apply what I know in a final project?</td>
<td>• Apply all aspects of the design process to a final project • Evaluate peers’ projects and provide growth-producing feedback</td>
<td>• Final Project with peer and instructor rubrics</td>
<td>Career Ready Practice CRP1,2,4,8</td>
<td>Literacy RST.9-10.1,2,4,7 WHST.9-10.2,4,7</td>
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<td>Pathway Standards ST-ET1,2,4,5</td>
<td>Math Science HS-ETS1-2 HS-ETS1-3</td>
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<td>Week 40</td>
<td>• How can I apply what I know in a final project?</td>
<td>• Apply engineering knowledge and principles to</td>
<td>• Final Exam</td>
<td>Career Ready Practice</td>
<td>Literacy RST.9-10.1,2,4</td>
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<td>Course Wrap-up and Evaluation</td>
<td>- What have I learned?</td>
<td>a topic as a final project c • Review for final exam.</td>
<td>CRP2,4,6,7,8,11</td>
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Program Overview
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Course Description
This course will continue the engineering concepts, practices and projects in the level 100 course and cover various aspects of the engineering profession. Students gain additional knowledge in career exploration, including pathways to selected engineering careers. They will work to further develop skills in professional and ethical responsibilities and behaviors. The course introduces students to technical drawing, the use of practical engineering tools, engineering design, CAD, data collection and analysis methods. Fundamentals of electricity, electrical circuits and input/output devices, as well as drive systems and hydraulics are also covered. Students continue to learn about education and licensing requirements, roles and responsibilities, regulatory agencies and work settings through various speakers and field trip experiences. Students learn and apply standard engineering nomenclature within the context of the subjects and utilize instruction and research for understanding the need for industry regulations and protocols. Research, teamwork, critical thinking and oral/written communication skills will also be expanded.

Course Objectives
- Students will understand and identify the major disciplines in the engineering field and associated pathways to becoming educated and licensed.
- Students will identify ethical and professional roles and responsibilities of the engineering profession.
- Students will apply teamwork, communication skills research practices to assigned projects.
- Students will learn and apply electrical, hydraulic and drive system concepts.
- Students will learn and apply basic skills in technical drawing and design, CAD and use of practical engineering tools.
- Students will learn and apply
• Students will 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

Equipment and Supplies
School will provide:
• Computer hardware and software
• Engineering and drawing tools and measurement instruments.
• Plotter/printer
Student will provide:
• 3-Ring Binder
• Dividers
• Writing utensils – pens and pencils
• Notebook and filler paper

Textbook
TBD

Grading
First and Second Quarter
25% Homework and Quizzes
25% Tests, Reports/Research Papers
25% Technical Drawings and Projects
25% Professionalism

Third and Fourth Quarter
20% Homework, Quizzes, Tests
20% Technical Writing
20% Projects
20% Data Analysis Application
20% Professionalism

Course Calendar

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Units of Study</th>
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</table>
| 1       | • Introduction to Engineering and Engineering Career Pathways  
        | • Roles & Responsibilities of Engineers  
        | • Ethics in Engineering |
| 2       | • Electricity and Electrical Circuits  
        | • Drive Systems  
        | • Hydraulics |
| 3       | • Technical Drawing and CAD Design  
        | • Use of Practical Measuring Tools  
        | • Simple Machines |
| 4       | • Failure Analysis  
        | • Data Collection and Analysis  
<pre><code>    | • Final Project Presentations |
</code></pre>
<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Key Questions</th>
<th>Key Learning Targets</th>
<th>Assessment Evidence of Learning</th>
<th>Related Standards</th>
<th>CCLS Literacy, Math, ELA</th>
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<tbody>
<tr>
<td>Week 1-2</td>
<td>• Who are you? • What do you think this course is about? • What procedures</td>
<td>• Understand and engage in icebreaker and “getting to know you” exercises • Explain</td>
<td>• Students will learn about other students and staff • Safety quiz • Compliance with safety rules</td>
<td>Career Ready Practices</td>
<td>Literacy RST.9-10.1,2,4</td>
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<td>and safety practices will be important in this class? • What does respect</td>
<td>and procedures • State and apply safety rules and procedures for the class and school</td>
<td>and procedures</td>
<td>CRP2,4,7,10</td>
<td>WHST.9-10.2,7,8,9</td>
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<td>and leadership mean?</td>
<td>• Discuss classroom respect and leadership</td>
<td>CCLLS Literacy, Math, ELA</td>
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<td>Week 3</td>
<td>• What are the roles and responsibilities of engineers? • What are the</td>
<td>• Describe the tasks engineers perform • Define the duties and obligations of</td>
<td>• Guest speaker. Rubric • Quiz on roles and responsibilities of engineers • Group projects</td>
<td>Cluster Standards</td>
<td>ELA R.9-10.3,5</td>
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<td>personal attributes of successful engineers? • What are the legal/ethical</td>
<td>engineers • Understand the personal attributes to consider when pursuing an</td>
<td>illustrating the personal attributes necessary for success in engineering with rationale about why</td>
<td>ST1,4,5</td>
<td>W.9-10.1 S.9-10.1,3,6 L.9-10.3,4,6</td>
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<td>responsibilities for engineers? • What does teamwork look like in engineering</td>
<td>engineering career • Explain the concept of teamwork in businesses employing</td>
<td>the attributes are important • Teamwork problem solving activity: Strategic plan for</td>
<td>Pathway Standards</td>
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<td>with U.S. companies? • How do U.S. companies manage engineering teams with</td>
<td>engineers • Determine a plan for the management of U.S. based companies with sites</td>
<td>collaborating with overseas teams Rubric</td>
<td>ST-ET1,2</td>
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<td>locations overseas?</td>
<td>abroad</td>
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<td>Week 4</td>
<td>• What types of engineering titles exist within the profession? • What is the</td>
<td>• Describe duties of engineers • Understand the responsibilities and duties</td>
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<td>Career Ready Practices</td>
<td>Literacy RST.9-10.1,2,4</td>
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<td>demand for</td>
<td>• Research project and presentations on selected engineering careers</td>
<td></td>
<td>CRP1,2,4,8,10,12</td>
<td>WHST.9-10.2,7,8,9</td>
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<td>Cluster Standards</td>
<td>ELA R.9-10.1,3,7</td>
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<td>ST4,5</td>
<td>W.9-10.1,2,3,6,7,8 SL.9-10.1-5</td>
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<td>Pathway Standards</td>
<td>L.9-10.1,2,4,6</td>
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<td>ST-ET4</td>
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<td>ST-ET4</td>
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NOTE: CCLS Literacy, Math, ELA: Refers to the Common Core State Standards for Literacy, Mathematics, and English Language Arts.

Career Ready Practices (CRP): These standards are closely aligned with the New York State Career Ready Practices.

Cluster Standards: These standards are part of the Pathway Standards and Cluster Standards in the CTE Program.

Pathway Standards: These standards are specific to the Pathway and are designed to prepare students for specific career paths.
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<td>Week 5-6 Use of Practical Measuring Tools</td>
<td>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?</td>
<td>of engineers  • Explain the legal and ethical responsibilities of engineering  • Identify the organizations for engineering professionals  • Understand the need for policies and regulations for the profession</td>
<td>Field trip to engineering company  • 21st Century Rubric  • Written assessment on roles and responsibilities in the profession  • Discussion of legal and ethical responsibilities in engineering-Group Activity Rubric  • Discussion of current articles and research in ethics in engineering - Group Activity Rubric</td>
<td>Pathway Standards</td>
<td>Pathway Standards  • ELA R.9-10.1-7  W.9-10.1,2,4-8  SL.9-10.1,2,4-6  L.9-10.1,2,3,4,6</td>
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<td>Weeks 7-8: Mechanical / Electrical Engineering</td>
<td>What is the relationship between English and metric linear measurement?  • What tools are used for measurements in engineering?</td>
<td>Convert English to metric linear measurement  • Apply metric measurement to design models  • Identify measurement tools used in mechanical and electrical engineering</td>
<td>Hands-on test of use of measuring instruments</td>
<td>Pathway Standards  • Career Ready Practices CRP1,2,4,7,11  • Cluster Standards ST2,6  • Cluster Standards ST-SM2</td>
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<td><strong>Weeks 9-10</strong>&lt;br&gt;Fundamentals of electricity</td>
<td>• What are the education and licensing requirements for mechanical/electrical engineers?  &lt;br&gt;• Where do mechanical engineers work?</td>
<td>mechanical or electrical engineers  &lt;br&gt;- Explain the education and licensing requirements for mechanical or electrical engineers  &lt;br&gt;- Understand the career paths for mechanical or electrical engineers  &lt;br&gt;- Describe the physical settings and/or types of companies that employ mechanical or electrical engineers</td>
<td>engineering steps needed for the development of a selected product  &lt;br&gt;Rubric  &lt;br&gt;- Research paper on mechanical or electrical engineering career paths, education, and degree required  &lt;br&gt;- Field trip to engineering facility  &lt;br&gt;21st Century Rubric</td>
<td>Pathway Standards ST-SM3</td>
<td>ELA  &lt;br&gt;R.9-10.1-4  &lt;br&gt;W.9-10.1,2,4,8  &lt;br&gt;SL.9-10.1,2,4,6  &lt;br&gt;L.9-10.1,2,4,6  &lt;br&gt;Math  &lt;br&gt;Science</td>
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<tr>
<td><strong>Weeks 11-12</strong>&lt;br&gt;Electrical Circuit Components</td>
<td>• What is Ohm’s Law?  &lt;br&gt;• What is magnetism?  &lt;br&gt;• What is a resistor and how are resistors measured?  &lt;br&gt;• What are volts, amps and resistance?  &lt;br&gt;• What are circuits?  &lt;br&gt;• What is electricity?  &lt;br&gt;• Can you name the differences between alternating and direct current?  &lt;br&gt;• What is engineering notation?</td>
<td>• Understand Ohm’s Law  &lt;br&gt;• Identify volts, amps and resistance in electrical theory  &lt;br&gt;• Understand magnetism as it applies to electrical theory  &lt;br&gt;• Use a resistor color code chart  &lt;br&gt;• Define electricity  &lt;br&gt;• Explain ways in which electricity is generated, transmitted, and used  &lt;br&gt;• Describe the how AC and DC are different?</td>
<td>• Vocabulary of electrical terms assignment  &lt;br&gt;• Worksheets  &lt;br&gt;• Summative assessments  &lt;br&gt;• Performance evaluations  &lt;br&gt;• Skill sheet assessment  &lt;br&gt;• Quiz relating to electrical symbols</td>
<td>Career Ready Practices ST4,5  &lt;br&gt;Cluster Standards ST-SM3  &lt;br&gt;Pathway Standards ST-SM3</td>
<td>Literacy  &lt;br&gt;RST.9-10.1,2,4  &lt;br&gt;WHST.9-10.2,7,8,9  &lt;br&gt;Math  &lt;br&gt;Science  &lt;br&gt;HS-PS 3-5  &lt;br&gt;HS-PS 3-6</td>
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<td>• What are the basic components of an Electrical circuit?  &lt;br&gt;• What are the types of power supplies?  &lt;br&gt;• What is an electrical schematic?</td>
<td>• Describe the function of the four basic components of an electrical circuit  &lt;br&gt;• Describe the operation of two types of power supplies  &lt;br&gt;• Draw a schematic sing the symbols for circuit components</td>
<td>• Electrical terminology quiz  &lt;br&gt;• Performance quiz on calculating and measuring volts, ohms, amps  &lt;br&gt;• Troubleshoot a simple circuit</td>
<td>Career Ready Practices ST1  &lt;br&gt;Cluster Standards ST1  &lt;br&gt;Pathway Standards ST-ET2,4</td>
<td>Literacy  &lt;br&gt;RST.9-10.1,2,3,7  &lt;br&gt;WHST.9-10.2,4  &lt;br&gt;ELA  &lt;br&gt;R.9-10.3,4  &lt;br&gt;W.9-10.1,2,4,5  &lt;br&gt;SL.9-10.1,2</td>
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</table>
| Week 13-14              | - What are manual input devices?  
- What is the meaning of NO and NC?  
- Identify three manual input devices?  
- Why do engineers use electrical schematic drawings for manual input devices? | - Correctly identify each manual input device  
- Explain the difference between NO and NC  
- Draw an electrical schematic and legend  
- Construct a circuit using input and output device by reading a schematic | - Performance task to construct a simple circuit  
- Troubleshoot a simple circuit | Career Ready Practices  
CRP2,4,8,11 | Literacy  
RST.9-10.1,2,3,7  
WHST.9-10.2,4  
Career Ready Practices  
CRP2,4,8,11 | Literacy  
RST.9-10.1,2,3,7  
WHST.9-10.2,4  
Career Ready Practices  
CRP2,4,8,11 | Literacy  
RST.9-10.1,2,3,7  
WHST.9-10.2,4  
Career Ready Practices  
CRP2,4,8,11 | Literacy  
RST.9-10.1,2,3,7  
WHST.9-10.2,4  
Career Ready Practices  
CRP2,4,8,11 | Literacy  
RST.9-10.1,2,3,7  
WHST.9-10.2,4  
Career Ready Practices  
CRP2,4,8,11 |
| **Input/output Devices** |               |                                                          |                               |                 |                          |
| Week 15                 | - What is the function of a mechanical drive?  
- Can you name the methods of rotary mechanical power?  
- Why are safety rules for power transmission equipment important?  
- When do we use Lockout/tagout?  
- 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 procedures  
- Name and assemble three types of foundations  
- Use set-up devices | - Performance evaluations  
- Application of safety rules practical situations  
- Quiz/test  
- Individual projects: Constructing a functioning simple machine | Career Ready Practices  
CRP2,4,8,11 | Literacy  
RST.9-10.1,2,3,7  
WHST.9-10.2,4  
Career Ready Practices  
CRP2,4,8,11 | Literacy  
RST.9-10.1,2,3,7  
WHST.9-10.2,4  
Career Ready Practices  
CRP2,4,8,11 | Literacy  
RST.9-10.1,2,3,7  
WHST.9-10.2,4  
Career Ready Practices  
CRP2,4,8,11 | Literacy  
RST.9-10.1,2,3,7  
WHST.9-10.2,4  
Career Ready Practices  
CRP2,4,8,11 | Literacy  
RST.9-10.1,2,3,7  
WHST.9-10.2,4  
Career Ready Practices  
CRP2,4,8,11 | Literacy  
RST.9-10.1,2,3,7  
WHST.9-10.2,4  
Career Ready Practices  
CRP2,4,8,11 |
<p>| <strong>Mechanical Drive Systems</strong> |               |                                                          |                               |                 |                          |
| Week 15                 |               |                                                          |                               |                 |                          |
|                         |               |                                                          |                               |                 |                          |
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| **Week 16** | • 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 key  
• Measure and cut a key from stock  
• Assemble a motor coupling  
• Vocabulary of fasteners terminologies  
• Lab practicals  
• Worksheets  
• Unit Exam | | **Career Ready Practices**  
CRP2,4,8,11 | | **Literacy**  
RST.9-10.1,2,3,7  
WHST.9-10.2,4 |
| **Cluster Standards**  
ST3  
MN6 | | | | | **Math**  
A-CED.4  
F-IF.6  
**Science**  
HS-PS 3-3  
HS-ETS 1-2  
HS-ETS 1-3 |
| **Pathway Standards**  
MN-HSE1 | | | | | | **ELA**  
R.9-10.3,4-6  
W.9-10.1,2,8  
SL.9-10.3,6  
L.9-10.3,4,6 |
| **Week 17-18** | • 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 • 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 | | **Career Ready Practices**  
CRP2,4,8,11 | | **Literacy**  
RST.9-10.1,2,3,7  
WHST.9-10.2,4 |
| **Cluster Standards**  
ST3  
MN6 | | | | | **Math**  
S-IC.4  
A-CED.4  
**Science**  
HS-PS 3-3 |
| **Pathway Standards** | | | | | | | **ELA**  
R.9-10.1-4  
W.9-10.1,2,4,5  
SL.9-10.1,3  
L.9-10.1-4 |
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<td>Week 19-20 Spur Gears / Multiple Shaft Drives</td>
<td>• 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 does it determined?</td>
<td>• 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</td>
<td>• Vocabulary assignment • Research project on the application of a gear drive system. (Rubric) • Worksheets • Unit exam • Performance evaluation</td>
<td>Career Ready Practices CRP2,4,8,11</td>
<td>Math A-CED.4 F-IF.4 A-REI.6 Science HS-ETS 1-2 HS-ETS 1-3</td>
</tr>
<tr>
<td>Week 21-22 V-Belt and Chain Drives</td>
<td>• What are the basic types and components of a Belt and Chain Drive? • How is a Belt size determined? • How might you describe Pitch? • What is tension and deflection?</td>
<td>• Identify belt and chain types • Identify the basic components of a belt or chain drive system • Measure and size V-belt</td>
<td>• Vocabulary of Belt and Chain Drives Worksheets • Quizzes • Unit Exam • Performance evaluation</td>
<td>Career Ready Practices CRP 2,4,8,11</td>
<td>Literacy RST.9-10.1,2,3,7 WHST.9-10.2,4 ELA R.9-10.1-7 W.9-10.1,2,4-8 SL.9-10.1-5 L.9-10.1-4,6 Math A-REI.1 A-CED.2,4 F-IF.6 F-TF.1 Science HS-PS2-1</td>
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Week 19-20
Spur Gears / Multiple Shaft Drives

Week 21-22
V-Belt and Chain Drives

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<td>• 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 does it determined?</td>
<td>• 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</td>
<td>• Vocabulary assignment • Research project on the application of a gear drive system. (Rubric) • Worksheets • Unit exam • Performance evaluation</td>
<td>Career Ready Practices CRP2,4,8,11</td>
<td>Math A-CED.4 F-IF.4 A-REI.6 Science HS-ETS 1-2 HS-ETS 1-3</td>
</tr>
<tr>
<td>Week 21-22 V-Belt and Chain Drives</td>
<td>• What are the basic types and components of a Belt and Chain Drive? • How is a Belt size determined? • How might you describe Pitch? • What is tension and deflection?</td>
<td>• Identify belt and chain types • Identify the basic components of a belt or chain drive system • Measure and size V-belt</td>
<td>• Vocabulary of Belt and Chain Drives Worksheets • Quizzes • Unit Exam • Performance evaluation</td>
<td>Career Ready Practices CRP 2,4,8,11</td>
<td>Literacy RST.9-10.1,2,3,7 WHST.9-10.2,4 ELA R.9-10.3,4,7 W.9-10.1,4,8 SL.9-10.1,3 L.9-10.1,2,4 Math A-REI.1 A-CED.2,4 F-IF.6 F-TF.1 Science HS-PS2-1</td>
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<tr>
<td>Time Frame Unit of Study</td>
<td>Key Questions</td>
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<td>Assessment Evidence of Learning</td>
<td>Related Standards</td>
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| **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  
• Understand uses for multi-view drawings  
• Apply basic drawing techniques to project design | • Class discussions using terminology in the context of the subject  
• Application of simple drawing techniques to basic projects | **Career Ready Practices**  
**Cluster Standards**  
ST 1 | **Literacy**  
RST.9-10.1,2,3,7  
WHST.9-10.2,4 |
| **Weeks 26-27**         | **Intro to CAD** | • What is CAD and what makes it different?  
• What are some different types of CAD applications?  
• What is important to consider in using CAD? | • Describe essential drawing tools in CAD  
• Apply CAD drawing applications to basic designs  
• Differentiate between CAD and other drawing tools | • Quiz on terminology  
• Written critique on pros and cons of CAD  
• Application of CAD software in project design-Rubric | **Career Ready Practices**  
**Cluster Standards**  
ST6 | **Literacy**  
RST.9-10.1,2,3,7  
WHST.9-10.2,4 |
| **Weeks 28-29**         | • What is Fluid Power? | • Describe Hydraulics | • Lesson review sheets | **Career Ready Practices** | **Literacy**  
RST.9-10.1,2 |
<table>
<thead>
<tr>
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<th>Key Questions</th>
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<tr>
<td>Hydraulics</td>
<td>• Why are hydraulics used? • What are Pascal’s laws? • What is viscosity?</td>
<td>• Explain the principles of hydraulics • List and explain the components used in a hydraulic system • Utilize the principles of Pascal’s Laws • Explain viscosity</td>
<td>• Component identification worksheet</td>
<td>CRP1,2,4,8,9</td>
<td>Cluster Standards ST3</td>
<td>WHST.9-10.2,4</td>
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<td>Weeks 30-32</td>
<td>Introduction to Problem Solving Failure Analysis</td>
<td>• What is the importance of problem solving and how do engineers apply problem solving skills? • Why is failure analysis important to engineers and what are its impacts in engineering? • What is Rapid Root Cause Analysis (RRCA)? • How is data analysis applied to failure analysis?</td>
<td>• Understand the application of problem solving to the design process • Analyze and troubleshoot designs • Analyze structural integrity • Understand about why structures fail</td>
<td>Career Ready Practices CRP1,2,4,8</td>
<td>Cluster Standards ELA R.9-10.1,3 W.9-10.1,8 SL.9-10.3,6 L.9-10.1,4</td>
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<td>Math A-CED.4 A-REI.1 G-GMD.3,4 G-MG.2,3</td>
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<td>Pathway Standards ST-ET5</td>
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<td>Weeks 33-34</td>
<td>Simple Machines</td>
<td>• What are the six classic machines? • How are the six machines similar and different? • How can I apply what I have learned?</td>
<td>• Identify the six classic machines and explain their use • Distinguish similarities and differences of the six</td>
<td>Career Ready Practices CRP1,2,3,4,8,9</td>
<td>Cluster Standards ELA R.9-10.1,3,4-6 W.9-10.1,4,5</td>
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<td>Math SIC.1 SID.1.2.4.6 S-CP.1 F-LE.1</td>
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<td>Science HS-ETS1-2 HS-ETS1-3</td>
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| **Week 35** | **Computer Programs** | • What are the common programs used in engineering?  
• How have they improved today’s production processes? | • Simple machines  
• Apply collaborative and critical thinking skills to project planning and development  
• Develop a final project proposal | Pathway Standards  
ST-ET2,5 | SL.9-10.1,4  
L.9-10.1,2,4 |
|            |               | • 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-Rubric | Career Ready Practices  
CRP2,4 | Math  
G-SRT.6,8  
A-CED.4  
Science  
HS-PS2-1  
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? | • Understand the importance of Statistical Process Control to our society  
• Analyze product data to predict product outcomes  
• Compose product outcomes for sets of data  
• Written report on root cause of failure through analysis of given problem and data | Pathway Standards  
ST-ET2,5 | ELA  
R.9-10.3,4  
W.9-10.1,2,4  
SL.9-10.1,4  
L.9-10.1,4  
Math  
A-CED.1,4  
Science  
HS-ETS1-2  
HS-ETS1-3 |
|            |               | • Application of engineering software in product design exercises-Rubric | | Cluster Standards  
ST2 | Literacy  
RST.9-10.1,2,3,7  
WHST.9-10.2,4 |
|            |               | | | Career Ready Practices  
CRP2,4,8 | ELA  
R.9-10.3,5  
W.9-10.1,4,5  
SL.9-10.1,3  
L.9-10.1-4,5 |
|            |               | | | Cluster Standards  
ST-SM4 | Math  
SIC.1  
SID.1.2,4,6  
S-CP.1  
F-LE.1 |
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<th>Related Standards</th>
<th>CCLS Literacy, Math, ELA</th>
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</table>
| Week 37    | • What are ethics?  
• What are the ethical obligations of engineers?  
• What are the results of non-ethical practices?  

• Understand how engineering decision are based on ethical decisions  
• Understand the relationship between ethical decisions and product safety  

• Research paper on ethical impact of product failures | Career Ready Practices  
CRP1,9  
Cluster Standards  
ST3  
Pathway Standards  
ST-ET6 | Related Standards | CCLS Literacy, Math, ELA |
| Ethics     | • How can I apply what I know in a final project?  
• Apply engineering principles and knowledge to a topic as a final project  
• Evaluate peers projects and provide growth-producing feedback  

• Final Project with peer and instructor rubrics | Career Ready Practices  
CRP1,2,4,7,8,9,11  
Cluster Standards  
ST6  
Pathway Standards  
ST-ET5 | Related Standards | CCLS Literacy, Math, ELA |
| Weeks 38-39| • 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  
CRP1,2,4,7,8,9,11  
Cluster Standards  
ST6 | Related Standards | CCLS Literacy, Math, ELA |
| Final Project Presentations | | | | | |
| Week 40    | • 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  
CRP1,2,4,7,8,9,11  
Cluster Standards  
ST6 | Related Standards | CCLS Literacy, Math, ELA |
<p>| Course Wrap-up and Evaluation | | | | | |</p>
<table>
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<th>Time Frame Unit of Study</th>
<th>Key Questions</th>
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<td>Pathway Standards ST-ET5</td>
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<td>ELA</td>
<td>R.9-10.3,4</td>
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<td>SL.9-10.1,6</td>
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<td>L.9-10.1,3,6</td>
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**Math**

**Science**
Syracuse City School District  
Career and Technical Education Program  
Course Syllabus  
PTM300: Mechanical Technology 300

Program Overview
Students will develop critical and analytical thinking, troubleshooting and problem solving skills through hands-on activities in this project-based curriculum. Mechanical concepts and processes are taught and topics include ethics in engineering, technical drawing and cad design, measuring tools, simple machines, failure analysis, and data collection and analysis. Career pathways are explored and skills are enhanced through work-based experiences. The PTECH program offers the opportunity to earn college credits toward a Mechanical Technology degree. Upon completion of PTT100-300, students will earn 11th grade science credit, and following the successful completion of PTT 100-400, students will be awarded specialized math and 12th grade ELA credits.

Course Description
Mechanical Technology is an introduction to basic concepts underlying the computer and its applications in technology and science fields. The focus is on studying the computer for acquiring and presenting information, using spreadsheets to solve problems, collecting and storing data and word processing documents. Topics include: Hardware and software computer concepts, introduction to internet to acquire and share information, introduction to spreadsheet applications for solving problems and charting, and using text editors in word processing documents. Introduction to technical presentations, use of application programs for organizing data, and drawing charts and schematics are also covered. Student will develop professional skills along with the application of engineering theory into practice.

Pre-Requisites
PTT100, PTT200 and Regents Math

Course Objectives
Students will:
1. Demonstrate the ability to use Microsoft (MS) Office applications through hands-on activities including the use of the Windows operating system.
2. Build quality reports with MS Word.
3. Analyze technical data with MS Excel.
4. Integrate information from both MS Word and Excel.
5. Prepare PowerPoint presentations.
7. Produce and deliver MS PowerPoint presentations.

Integrated Academics
11th grade integrated Science Credit
Equipment and Supplies
- **School will provide**: Laptop Computers, and software programs.
- **Student will provide**: Notebook and writing utensils.

Textbook
No Textbook is required

Grading

<table>
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<th>First and Second Quarter</th>
<th>Third and Fourth Quarter</th>
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<tr>
<td>25% Assigned Coursework</td>
<td>20% Assigned Coursework</td>
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<td>25% Lab Projects</td>
<td>20% Lab Projects</td>
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<tr>
<td>25% Quizzes and Assessments</td>
<td>20% Participation</td>
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<tr>
<td>25% Professionalism &amp; Participation</td>
<td>20% Quizzes and Assessments</td>
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<td>20% Professionalism</td>
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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 me 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 failure on exam, paper or project.

Course Calendar

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Units of Study</th>
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<tbody>
<tr>
<td>1</td>
<td>• Introduction to Engineering and Engineering Career Pathways</td>
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<td>• Personal &amp; Professional Characteristics in Mechanical Technology</td>
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<td>• Intro to Basic Computer Applications</td>
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<td>• Inputting and Modifying Data, Basic Formatting &amp; Formulas</td>
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<td>• Using Averages, Percent Weighting, and IF statements</td>
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<td>• Technical Reports &amp; PowerPoint Presentations</td>
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<td>• Percent Error, Elementary Statistics &amp; Plotting Data Results</td>
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<td>• Industry Cert Assessment (NOCTI)</td>
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<td>• Understanding Formulas and Plots in Excel</td>
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<td>2</td>
<td>• Conversion and Calculation</td>
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<td>• Engineering Lists &amp; Historical Logs</td>
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<td>• Intermediate Formulas and Mechanical Analysis</td>
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<td>• Product Proposals and Marketing</td>
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<td>• Electrical Plotting and Analysis</td>
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<td>• Advanced Statistics and Data Analysis in Excel</td>
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<td>• Engineering Functions in Excel</td>
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<td>• Curve Fitting and Plotting in Excel</td>
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<td>• Tables and Selecting Data for Engineering Calculation</td>
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<td>• Final Comprehensive Project with Industry Professionals</td>
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<td>Time Frame/Unit of Study</td>
<td>Key Questions</td>
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<td><strong>Week 1</strong> Int</td>
<td>Who are you? • What are the course expectations? • What are the classroom procedures and safety practices? • What are the objectives of this course? • Can you identify the benefit of this course in a future professional environment?</td>
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<td><strong>Week 2</strong> Unit 2</td>
<td>What is time management? • Can you name the professional characteristics necessary for success in the engineering field? • How do your habits influence the way you present yourself to others? • What habits and</td>
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<td><strong>Pathway Standards</strong></td>
<td>Cluster Standards ST-SM1,2,4</td>
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<td><strong>Cluster Standards</strong></td>
<td>Cluster Standards ST2,3,4,6</td>
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<td><strong>Literacy</strong></td>
<td>RST.11-12.4,9 WHST.11-12.4,6 ELA R.I.3,4,7 L.1,2,4 SL.1,2,4,5 Math</td>
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<td><strong>Week 3</strong></td>
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<td>Unit 3</td>
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| **Introduction to Basic Computer Applications** | practices do you need to work on during this course? | • What is the function of Microsoft Excel and Word?  
• How is data analysis useful to the engineering industry?  
• Can you describe connections between process improvement and data statistics?  
• How has excel revolutionized the analysis of engineered data previously completed without computers? | • Lab application of basic Excel and Word functions  
• Creation of a basic weekly schedule  
• Creation of a business letter template | Career Ready Practices  
CRP1,2,4,5,6,8,9,11 | Science |
|                          |               | • Describe the primary purpose of Microsoft Excel and Word applications  
• Explore menus, tools and functional capabilities of Excel and Word  
• Open, create, and save documents  
• Perform basic formatting Excel and Word |                                 | Pathway Standards  
ST-SM1,2,4 | |
|                          |               | • Discuss how data analysis affects the choices applied to engineered designs or processes  
• Generate a pay stub table, identify gross vs net pay, utilize basic math calculations, and utilize percentages in excel  
• Create linear equation plots  
• Explore Excel as it applies to data and chart plotting  
• Plot results as a graphical | Students will apply techniques learned within assignments for submittal and feedback  
Lab: Assigned application projects (Rubric)  
First Submission to “Office 365 One Note” | Career Ready Practices  
CRP 1,2,4,5,6,8,9,11 | Literacy  
RST.11-12.4,9  
WHST.11-12.4,6 |
|                          |               |                                                         |                                 |                  |                            |
| **Week 4**               |               |                                                         |                                 |                  |                            |
| Unit 4                   |               |                                                         |                                 |                  |                            |
| **Inputting and Modifying Data, Basic Formatting & Formulas** | Are you able to describe gross income?  
How is net pay defined and calculated?  
How are percentages converted to decimals?  
How can unit conversion be important to engineers utilizing complex equations in calculations? | • Are you able to describe gross income?  
How is net pay defined and calculated?  
How are percentages converted to decimals?  
How can unit conversion be important to engineers utilizing complex equations in calculations?  
| Lab application of basic Excel and Word functions  
• Creation of a basic weekly schedule  
• Creation of a business letter template | Pathway Standards  
ST-SM1,2,4 | Math  
S-ID.7  
Science  
HS-ETS1-4 |
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| **Week 5**<br>**Unit 5**<br>**Using Averages, Percent Weighting, and IF statements** | • How are averages calculated?  
• How can percentages be used to weight grades?  
• What is the purpose or benefit of organized data tables, summary tables, and auto updating formulas?  
• In what ways might an Excel template be useful for engineers who frequently perform similar data analyses? | • Create gradebook with 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 tools, ribbon functions  
• Discuss advantages of using templates for analyzing data in daily engineering operations | • Project/Lab: Students apply functions and tools (Rubric)  
• Cloud computing submittal of assignment  
• Written summaries of improved efficiency in the use of electronic data analysis | **Career Ready Practices**<br>CRP1,2,4,5,6,8,9,11 | Science **HS-ETS1-4**  
Literacy **RST.11-12.4,9**  
**WHST.11-12.4,6**  
**ELA**<br>Ri.11-12.4,5,7  
W.11-12.1,8  
SL.11-12.1,3,5  
L.11-12.1,2,6  
**Math**<br>S-ID.2 |
| **Cluster Standards**<br>ST1,2,3,4,5,6 | **Pathway Standards**<br>ST-SM1,2,4 | **Pathway Standards**<br>ST-SM1,2,4 |
| **Week 6**<br>**Unit 6**<br>**Technical Reports & PowerPoint Presentations** | • What can we learn from an inspiring engineer of the past?  
• What are important attributes of a good public speaker?  
• Is it possible to save time through advanced skill in Microsoft Office programs? | • Demonstrate use of title page templates  
• Create an "auto updating" table of contents, citations, and bibliography in Microsoft Word  
• Create and present a short 3-4 min PowerPoint on selected subject | • PowerPoint presentations  
• Student self-assessment with a presentation rubric  
• Technical reports  
• Completed list of sources cited in a bibliography MLA or APA style | **Career Ready Practices**<br>CRP1,2,4,5,6,7,8,9,11,12 | **Literacy**<br>RST.11-12.4,9  
**WHST.11-12.4,6**  
**ELA**<br>Ri.11-12.1,2,3,5,7  
W.11-12.1-8  
SL.11-12.1,2,4,5  
L.11-12.1,2,3,6 | **Cluster Standards**<br>ST1,2,3,4,5,6 | **Math**
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| **Percent Error, Elementary Statistics & Plotting Data Results** | • Are you able to define histogram?  
• What is percent error used for?  
• What is the difference between SORT and FILTER in Excel?  
• Why is data analysis important in 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 (Rubric)  
• Vocabulary Quiz | Career Ready Practices  
CRP1,2,4,5,6,8,9,11,12  
Related Standards  
ST-SM1,2,4  
Science |
|                          |               |                                                         |                               |                   |
| **Week 8**               |               |                                                         |                               |                   |
| **Industry Certification Assessment** | • NOCTI Manufacturing Technology Assessment  
• NOCTI Manufacturing Technology Assessment | • Summative Industry Testing | Career Ready Practices  
CRP2  
Related Standards  
ST-SM1,2,4  
Science |                   |
|                          |               |                                                         |                               |                   |
| **Weeks 9-10**           |               |                                                         |                               |                   |
| **Unit 8**               |               |                                                         |                               |                   |
|                          | • What is Amortization plotting used for?  
• Understand the variables of an amortization plot and | • Project/Lab application of assigned formulas | Career Ready Practices  
CRP1,2,4,5,6,8,9,11  
Related Standards  
ST 5,6  
Science |                   |

**Related Standards**
- **CCLS Literacy, Math, Science**
- **Career Ready Practices CRP1,2,4,5,6,8,9,11,12**
- **ST-SM1,2,4**
- **Literacy RST.11-12.4,9 WHST.11-12.4,6**
- **Cluster Standards ST1,2,3,4,5,6**
- **Science HS-PS3-1 HS-PS3-6**
- **Math N-Q.3 S-ID.1,2,4,6**
- **Lit R1.11-12.1,3,7 W.11-12.1,6,8 SL.11-12.1,3,5 L.11-12.1,2,3,6**
<table>
<thead>
<tr>
<th>Time Frame/Unit of Study</th>
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<th>Key Learning Targets (Students will know and be able to)</th>
<th>Assessment Evidence of Learning</th>
<th>Related Standards</th>
<th>CCLS Literacy, Math, Science</th>
</tr>
</thead>
</table>
| **Understanding Formulas and Plots in Excel** | • How could understanding a loan payment schedule be important to manufacturing facilities?  
• When expensive equipment is procured by a company, could they use amortization plotting to finance their purchase? | generate loan payment schedules  
• Assess and analyze data  
• Use and apply math formulas to analyze data tables in excel | and plotting activities (Rubric)  
• Terminology Quiz | | ELA  
RI.11-12.1,3,4,7  
W.11-12.1,8  
SL.11-12.1,2,3  
L.11-12.1,3,6 |
| **Cluster Standards** | Math  
A-SSE.3  
F-IF.6,8  
F-BF.1.2 | | | |
| **Pathway Standards** | Science  
HS-PS2-1  
HS-PS3-5 | | | |
| **Week 11-12**  
**Unit 9**  
**Conversions and Calculation** | • How could excel be beneficial as a quick unit conversion calculator?  
• What are common equations that utilize unit conversion?  
• Do people do unit conversion in daily life with time, distance, or money? | • 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 in conversions and calculations (Rubric)  
• Word problem and unit conversion assignments | Career Ready Practices  
CRP1,2,4,5,6,8,9,11 | Literacy  
RST.11-12.4,9  
WHST.11-12.4,6 |
| **Cluster Standards** | Math  
A-CED.4  
N-Q1 | | | |
| **Pathway Standards** | Science  
HS-PS2-1  
HS-PS3-5  
HS-PS3-6 | | | |
| **Week 13-14**  
**Unit 10**  
**Engineering Lists & Historical Logs** | • What is the definition of a List?  
• What is the purpose of an engineering log template?  
• Why would a | • Apply key terms and engineering vernacular  
• Create important engineering lists and historical data logs commonly created in | • Creation of excel database  
• Project/Lab application of Excel functions and tools (Rubric)  
• Terminology Quiz | Career Ready Practices  
CRP1,2,4,5,6,8,9,11 | Literacy  
RST.11-12.4,9  
WHST.11-12.4,6 |
| **Cluster Standards** | Math  
A-SSE.3  
W.11-12.1,3,4,7  
SL.11-12.2,4,6  
SL.11-12.1,2,4,6 | | | |
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</thead>
</table>
| Week 15-18              | manufacturing facility need an "Approved Vendor List"?  | industry  
• Pull important information from engineering motor database.  
• Utilize the FILTER and FREEZE PANES tools in Excel  | Students will apply intermediate formulas in Excel  
• Project/Lab with write up and excel plots  
• Analysis of mechanical data using Excel  
• Terminology quiz  | Career Ready Practices  
CRP1,2,4,5,6,8,9,11  | Literacy  
RST.11-12.4,9  
WHST.11-12.4,6  
ELA  
RI.11-12.3,4,7  
W.11-12.1,2,4,9  
S.11-12.1,2,3,4  
L.11-12.1,2,6  | Math  
A-SSE.1  |
| Unit 11                 | What issues would occur if we design and build a product without a proper "Bill of Materials"?  
• How could an engineer be more effective in his/her role using a "Lessons Learned Log"?  | students will know and be able to  
• Mathematically model spring constant data  
• Analyze critical information for solution of the model  
• Understand the differential equation variables provided  
• Discuss how civil engineers use calculations in project design  | Career Ready Practices  
CRP1,2,4,5,6,8,9,11  | Pathway Standards  
ST-SM1,2,4  | Science  
HS-ETS 1-3  
HS-ETS 1-4  |
| Intermediate Formulas and Mechanical Analysis in Excel | What is a spring constant?  
• Are material selections important to engineers when designing a car suspension?  
• Can you define 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 damage from earthquakes?  |  |  |  |  |
| Week 19-20              | What is the fundamental  | Develop rectified wave plot from engineered data  | Terminology Quiz  
• Rectified Wave plot  | Career Ready Practices  
CRP1,2,4,5,6,8,9,11  | Literacy  
RST.11-12.4,9  
WHST.11-12.4,6  |  |  |  |  |
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<tbody>
<tr>
<td>Intermediate Formulas and Electrical Analysis in Excel</td>
<td>difference between AC and DC current • Why do electrical engineers rectify voltage? • What is the “period” of a wave equation? • What is amplitude and how is phase shift defined?</td>
<td>source • Create a lexicon of electrical engineering terminology • Demonstrate competence in data analysis using higher level formulas</td>
<td>activity • Project/Lab with write up and excel plots.</td>
<td></td>
<td>ELA RI.11-12.3,4,7 W.11-12.1,4,8 SL.11-12.1,2,4</td>
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<tr>
<td>Math</td>
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<td>Math A-CED.4 F-TF.5 N-Q.1</td>
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<td>Cluster Standards ST1,2,3,4,5,6</td>
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<td>Pathway Standards ST-SM1,2,4</td>
<td>Science HS-PS4-1 HS-PS4-2 HS-PS3-6</td>
</tr>
<tr>
<td>Week 21-23 Unit 13 Product Proposals and Marketing</td>
<td>• What is included in an engineer’s &quot;Career Profile,&quot; in addition to a resume? • Why does a company that manufactures engineered products provide customers with a technical product proposal? • How can you distinguish the difference between technical and commercial proposals?</td>
<td>• Support attractiveness to employer recruiting with an all-inclusive career profile • Develop a technical product proposal • Compare the difference between technical and commercial information</td>
<td>• Student presentations of product proposals • Student self-evaluation (rubric) • Development of Career Profiles</td>
<td>Career Ready Practices CRP1,2,4,5,6,8,9,11</td>
<td>Literacy RST.11-12.4,9 WHST.11-12.4,6</td>
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<td>Pathway Standards ST-SM1,2,4</td>
<td>Science HS-ETS 1-3</td>
</tr>
<tr>
<td>Week 24-26 Unit 14</td>
<td>• In the International System of Units, what</td>
<td>• Create a saw tooth wave plot in Excel</td>
<td>• Student Projects/Lab exercises (Rubric)</td>
<td>Career Ready Practices CRP1,2,4,5,6,8,9,11</td>
<td>Literacy RST.11-12.4,9 WHST.11-12.4,6</td>
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<tr>
<td>Continuing Electrical Plotting and Analysis</td>
<td>is a unit of electric charge called? • Who is Charles-Augustin de Coulomb what was his contribution to the electrical engineering field? • What is Fourier Analysis?</td>
<td>• Develop a square wave function with plot in Excel • Compare and contrast wave differences • Create a short technical report describing work completed • Discuss the contributions of Charles Augustin de Coulomb</td>
<td>• Fourier Analysis Activity</td>
<td>Cluster Standards ST1,2,3,4,5,6</td>
<td>ELA RI.11-12.1,3,6,7 W.11-12.1,2,3,6,7 SL.11-12.1-5 L.11-12.1-4,6</td>
</tr>
<tr>
<td>Week 27-30</td>
<td>What is Regression Analysis used for? • What is P Value telling us? • What is the difference between overhead (fixed) costs and variable costs? • What is a significant indicator?</td>
<td>• Model, develop, interpret, and evaluate regression analysis of actual industry data • Calculate and predict future electrical consumption in a manufacturing facility</td>
<td>• Project/Lab for students to apply understanding of advanced concepts/functions in excel (Rubric) • Electrical consumption analysis of a real manufacturing facility with empirical data</td>
<td>Career Ready Practices CRP1,2,4,5,6,8,9,11</td>
<td>Literacy RST11-12.4,9, WHST.11-12.4,6</td>
</tr>
<tr>
<td>Week 31-32</td>
<td>What is a Bessel Function? • What is the VLOOKUP function used for? • How is normalization used in data analysis?</td>
<td>• Build tables in Excel utilizing the BESSEL function • Perform a vertical lookup of data by searching for a value in the first column of a table and returning the value • Develop plots after</td>
<td>• Project/Lab with write up and excel plots. (Rubric)</td>
<td>Career Ready Practice CRP1,2,4,5,6,8,9,11 Cluster Standards ST1,2,3,4,5,6</td>
<td>Literacy RST11-12.4,9 WHST.11-12.4,6</td>
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<td>Unit 15</td>
<td>Advanced Statistics and Data Analysis in Excel</td>
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<td>Unit 16</td>
<td>Engineering Functions in Excel</td>
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<tr>
<td><strong>Week 33</strong></td>
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<tr>
<td>Unit 17</td>
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</tbody>
</table>
| Curve Fitting and Plotting in Excel | • What is Array Curve Fitting used for?  
• What does a 2nd order polynomial equation look like?  
• 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. (Rubric)  
• Applied Engineering Math Assignments | Career Ready Practice  
CRP1,2,4,5,6,8,9,11  
Cluster Standards  
ST1,2,3,4,5,6  
Pathway Standards  
ST-SM1,2,4 | Math  
S-ID.4  
S-CP.1  
Science  
Week 34 | Literacy  
RST.11-12.4,9  
WHST.11-12.4,6 |
| **Week 34**              |               |                                                         |                                 |                   |                             |
| Unit 18                  |               |                                                         |                                 |                   |                             |
| Tables and Selecting Data for Engineering Calculation | • Where do reference tables come from?  
• Why would engineers use reference tables?  
• What information is found on Steam Tables? | • Read and pull critical information from reference tables  
• Solve for missing reference information using interpolation  
• Understand and describe the importance of engineering reference tables | • Quiz on excel functions  
• Project/Lab skill application (Rubric)  
• Extracting important data from text strings of raw unfiltered data | Career Ready Practices  
CRP1,2,4,5,6,8,9,11  
Cluster Standards  
ST1,2,3,4,5,6  
Pathway Standards  
ST-SM1,2,4 | Math  
N-Q.1  
Science  
HS-PS3-5 |
<p>|                          |               | Normalizing data sets                                   |                                 |                   |                             |
|                          |               |                                                         |                                 |                   |                             |</p>
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</table>
| Week 35-40 Final Comprehensive Project with Industry Professionals | • What have we learned about the important Excel tools in this course?  
• Why are technical reports so important in the engineering industry?  
• How have we improved our professionalism and public speaking through the course? | • Generate experimental data and examine percent error between theoretical vs experimental data  
• Utilize engineering reference tables, interpolation, and theoretical derivation of engineering equations  
• Calculate results using engineering formulas and variables in Excel  
• Produce a presentation and technical report | • Mentor-based project utilizing industry partners for supply of authentic data and analysis requirements  
• Technical research & report documentation  
• Excel data analysis and plotting  
• Completion of a list of professional references, including mentor interview  
• Final PowerPoint presentation to professional panel | Career Ready Practices  
CRP1,2,4,5,6,8,9,11 | Literacy  
RST.11-12.4 9  
WHST.11-12.4,6  
ELA  
RL.11-12.1,3,6,7  
W.11-12.1,3,4,5,6,7,8  
SL.11-12.1,2,4,5,6  
L.11-12.1,2,3,6  
Math  
A-CED.4  
N-Q.1,3  
S-ID.1,2,4,6 |  
Cluster Standards  
ST1,2,3,4,5,6  
Pathway Standards  
ST-SM1,2,4 | Science  
HS-ETS1-1  
HS-ETS1-2  
HS-ETS1-3  
HS-ETS1-4 |
Program Overview
Students will develop critical and analytical thinking, troubleshooting and problem solving skills through hands-on activities in this project-based curriculum. Electrical and mechanical concepts and processes are taught and topics include ethics in engineering, technical drawing and cad design, measuring tools, simple machines, failure analysis, and data collection and analysis. Career pathways are explored and skills are enhanced through work-based experiences. The PTECH program offers the opportunity to earn college credits toward Electrical Engineering or Mechanical Technology degrees. Upon completion of PTP 100-300, students will earn 11th grade science credit, and following the successful completion of PTP 100-400, students will be awarded specialized math and 12th grade ELA credits.

Course Description
The Professional Technology and Cooperative Work Experience Program component expands and enhances skills taught throughout the P-TECH program. Students will be assigned mentors and work with specific manufacturing industry professionals who will facilitate growth opportunities according to the needs of mentoring enterprise. Topics include employability, professionalism, teamwork, time management, design theory problem and solving/analysis. Students will develop 21st Century skills with the application of engineering theory in authentic industry environments within the Syracuse Manufacturing field. Students will perform these internship experiences 5 periods per week.

Pre-Requisites
PTP 100, PTP 200, PTP 300

Course Objectives
1. Students will demonstrate professionalism in an industry environment with professionals.
2. Students will analyze technical data and apply engineering theory.
3. Students will prepare PowerPoint presentations.
4. Students will present results in front of a group.
5. Students will produce and deliver a high quality assignments meeting and exceeding expectations of industry mentors.

Integrated Academics
12th Grade integrated ELA Credit
Equipment and Supplies
• School will provide: Laptop Computers, and software programs.
• Student will provide: Notebook and writing utensils.

Textbook
No Textbook is required

Grading

<table>
<thead>
<tr>
<th>First and Second Quarter</th>
<th>Third and Fourth Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>25% Assigned Coursework</td>
<td>20% Assigned Coursework.</td>
</tr>
<tr>
<td>25% Mentor Projects</td>
<td>20% Mentor Projects</td>
</tr>
<tr>
<td>25% Quizzes and Assessments</td>
<td>20% Employability Skills</td>
</tr>
<tr>
<td>25% Professionalism &amp; Participation</td>
<td>20% Quizzes and Assessments</td>
</tr>
</tbody>
</table>

Additional Course Policies

Missed Classes: Students 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 me 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 failure on exam, paper or project.

Course Calendar

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Units of Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>• Professionalism &amp; Employability</td>
</tr>
<tr>
<td></td>
<td>• Mentor Lab Project 1</td>
</tr>
<tr>
<td></td>
<td>• Safety in the Manufacturing Facility</td>
</tr>
<tr>
<td>2</td>
<td>• NOCTI Certification Assessment</td>
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<td>• Time Management</td>
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<td>• Team Presentations</td>
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<tr>
<td>3</td>
<td>• Cooperative Work Experience with Industry Mentors</td>
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<td>• Mentor Lab Project 2</td>
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<td>• Project Solving &amp; Analysis</td>
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<td>4</td>
<td>• Cooperative Work Experience with Industry Mentors</td>
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<td>• Comprehensive Team Project &amp; Presentation</td>
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<td>• Mentor Lab Project 3</td>
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<td>• Design and Decision Theory</td>
</tr>
</tbody>
</table>
## Time Frame

### Unit of Study

<table>
<thead>
<tr>
<th>Quarter 1 &amp; 2</th>
<th>Core courses consisting of (College English, Math, College Science, Economics)</th>
<th>College Technical course sequence</th>
<th>Job Shadow</th>
<th>Senior independent project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarter 3 &amp; 4</td>
<td>Core courses consisting of (College English, Math, College Science, Economics)</td>
<td>College Technical course sequence</td>
<td>Job Shadow</td>
<td>College or Career preparation</td>
</tr>
</tbody>
</table>

### Key Questions

- Core courses follow each scope and sequence
- College technical course follow college sequence time line
- Why are job shadows important to my success?
- What are the opportunities available for employment?
- Student portfolio wrap-up
- Core High School and College classes follow course syllabus
- Compose and present a rational for or against the use of job shadows in the program
- Students finalize portfolios and prepare for future college or career

### Key Learning Targets (Students will know and be able to)

- Job shadow evaluations will be based on career coaches, business partners and company representative feedback and student reflections
- Students present portfolios to career coaches, perspective employers and instructors

### Assessment Evidence of Learning

- Core High School and College classes follow course syllabus
- Compose and present a rational for or against the use of job shadows in the program
- Students finalize portfolios and prepare for future college or career

### Related Standards

- Career Ready Practices
  - CRP2,4,7,10
- Cluster Standards
  - ST4,5
- Pathway Standards
  - ST-ET2

### CCLS Literacy, Math, ELA

- Literacy
  - RST.9-10.1,2,4
  - WHST.9-10.2,7,8,9
- ELA
  - R.9-10.3,5
  - W.9-10.1
  - S.9-10.1,3,6
  - L.9-10.3,4,6
- Math
  - Pathway Standards
  - ST-ET2
- Science