Corcoran High School
Computer Chip Design and Production Pathway
Summary Overview

Pathway Overview

This 4-year sequence of Computer Chip Design and Production courses will prepare students to enter the field of high technology fabrication. Students will be poised to enter the industry directly as a technician, or continue their education to obtain an associate's degree in electromechanical, mechatronics or Computer Chip Design and Production technology. Within this pathway students will explore career possibilities through research, field visits and professional mentoring. Students will obtain safety certification to work in an industrial setting, be able to apply background information in physics, chemistry, and math to understand the fabrication process and to trouble-shoot processes and machines. Students will have a solid background in applied electrical theory and clean laboratory protocols. Students will demonstrate their skills as technical readers and writers and demonstrate professional communication skills. Students will balance individual skills with group development skills including collaboration, communication, critical thinking, creativity, problem solving, perseverance, information literacy, technology skills, and digital literacy. They will develop awareness of motivating and supporting others including an awareness of diversity, ethical and professional practices. Students will have opportunities to pursue certifications including, but not limited to: OSHA 10, Microsoft Word and Excel, receive 18-24 college credits and other industry certifications demonstrating their knowledge and career readiness for this field.

Course Calendar- Level 1; 9th Grade

Quarter	Possible Driving Question/ Project	Units of Study
1	**How do semiconductors impact daily life?**	● Introduction to Class Expectations and Policies ● Introduction to Computer Chip Design and Production and Careers ● History of Semiconductor Development and Manufacturing ● Introduction to Programming ● Basic Safety in the Work Environment ● Applied Technical Math (Part 1)
2	**How has technology impacted drawing and planning?**	● Technical Drawing ● Introduction to Engineering Design ● Career Exploration
3	**What makes a good employee?**	● Digital Literacy ● Introduction to Material Science ● Career Exploration
4	**How can a creative experience help build understanding of a scientific process?**	● Materials and Process: Sand to Semiconductor ● Introduction to Photolithography ● Career Exploration and Reflection

Course Calendar-Level 2; 10th Grade

Quarter	Possible Driving Question/ Project	Units of Study
1	**What may be impacts of a clean room facility and protocols on working environment?**	● Class Expectations and Policies ● Safety Review ● Clean Room - Protocols and Etiquette ● Light ● Refrigeration Background ● Career Exploration
2	**How can you use equations to solve real-world problems?**	● Applied Technical Math- Geometry, Right Angle Trigonometry, Precision Measurements ● Tools and Gauges ● Theory of Electricity-Part 1 ● Career Exploration
3	**How do parts contribute to make a system?**	● Theory of Electricity-Part 2 ● Motor and Controls

		● Circuits
4	**How do scientific discoveries and advances impact manufacturing?**	● Logic Gates ● Vacuum- What, Why and How ● Career Exploration and Reflections

Course Calendar- Level 3- 11th Grade

Quarter	Possible Driving Question/ Project	Units of Study
1	**What impact may result from unclear or omitted documentation?**	● Class Expectations and Policies ● Safety Review ● Technical Reading and Writing ● Programming Fundamentals (part 1)
2	**How do processes and procedures lead to better solutions?**	● Programming Fundamentals (part 2) ● Introduction to Problem Solving ● Career Exploration
3	**How can we plan, prevent and respond to problems?**	● Fluid Power ● Mechanisms (note- may carry into fourth quarter)
4	**In what ways do current local, national, and global issues impact business and manufacturing decisions and practices?**	● Presentations with Data and Visuals ● Ethics and Emerging Technologies ● Programmable Logic Controls ● Career Exploration and Reflection

Course Calendar- Level 4; 12th Grade

Quarter	Possible Driving Question/ Project	Units of Study
1	**What is your vision for the future?**	● Course Expectations and Policies ● Goal Setting and Career Exploration ● Career Preparedness and Application Processes ● Employee Safety and Protection ● Preparation for Internship
2	**How can data be used to predict outcomes of future events or to make decisions?**	● Trouble-Shooting: Failure Analysis ● Trouble-Shooting: Statistical Process Control
3	**What makes a successful internship experience?**	● Internship
4	**How does design influence function/ practice and vice versa- how does function/practice influence design?**	● Career Development and Employability ● Internship Synthesis and Evaluation ● Extended Project ● Reflection

Corcoran High School
Computer Chip Design and Production Pathway
Course Syllabus
Level 1

Pathway Overview

This 4-year sequence of Computer Chip Design and Production courses will prepare students to enter the field of high technology fabrication. Students will be poised to enter the industry directly as a technician, or continue their education to obtain an associate's degree in electromechanical, mechatronics or Computer Chip Design and Production technology. Within this pathway students will explore career possibilities through research, field visits and professional mentoring. Students will obtain safety certification to work in an industrial setting, be able to apply background information in physics, chemistry, and math to understand the fabrication process and to trouble-shoot processes and machines. Students will have a solid background in applied electrical theory and clean laboratory protocols. Students will demonstrate their skills as technical readers and writers and demonstrate professional communication skills. Students will balance individual skills with group development skills including collaboration, communication, critical thinking, creativity, problem solving, perseverance, information literacy, technology skills, and digital literacy. They will develop awareness of motivating and supporting others including an awareness of diversity, ethical and professional practices. Students will have opportunities to pursue certifications including, but not limited to: OSHA 10, Microsoft Word and Excel, receive 18-24 college credits and other industry certifications demonstrating their knowledge and career readiness for this field.

Course Description

The first year provides foundational skills in safety, interpreting technical drawings, digital literacy, engineering design and applied math. Students will explore the history of the development of semiconductors and the relationship of photolithographic processes to Computer Chip Design and Production. Possible careers and the related working environments and educational requirements will be explored. A focus of student experience will be the development of efficient communication skills, critical thinking, and problem solving.

All students will engage in project-based learning at a minimum of a project each quarter. Intrinsic to project-based learning is to examine a driving question or identify a problem by articulating what is already known, and what students need to know to answer the question. Students are guided to develop and execute a plan culminating in a presentation or product demonstrating their response to the initial question or problem. This process concludes with self-reflection regarding their learning. As such, learning happens during project execution and not solely as a final activity to show learning.

Work-Based Learning

Students will be connected with local and national professionals throughout their learning experiences especially as they complete project-based learning experiences. These professional connections may include interviews, field trips to local businesses, virtual field trips to other locations, presenting their learning and work samples to professionals, job shadowing and career coaching. It is expected that these experiences will lead to opportunities for direct job training and real-world experience in an internship experience prior to completion of the program. Students will create and maintain a portfolio of their experiences to document the development of their skills, including a professional resume.

Additional Learning Opportunities

- **Micro-credentials:** Students may pursue learning experiences and credentials depending on the requirements of the project that they are involved in. Some examples for this pathway include, but are not limited to:
    - Microsoft Office Specialist: Word Associate and Excel Associate
    - OSHA 10 Hour
    - Other Industry Certifications (depending on teacher certification) such as CISCO, CompTIA

- **Summer Bridge Enrichment:** Students will have the opportunity to participate in cross-curricular Summer Bridge programs to enhance and enrich their skills. Students will explore and create solutions that address authentic needs in the school and wider community with the involvement of local industry professionals. Students will build on skills learned during the school year to work collaboratively with students from other pathways and programs.

Pre-Requisites

N/A

Course Objectives

Upon completion of the course students will know and be able to do:

- Explain basic history and process of computer chip design and production, the cleanroom environment and possible career opportunities.
- Demonstrate safety protocols in the work environment.
- Recognize hazards and take appropriate precautions to work in a safe manner.
- Demonstrate an understanding of the importance of proper handling, labeling, storing and communication of hazardous materials.
- Demonstrate how to add, subtract, multiply, and divide whole numbers, fractions, and decimals with the ability to convert between fractions, decimals, percentages, and ratios.
- Convert within and between metric and Imperial units, while using proper engineering notation and prefixes.
- Interpret varied types of technical drawings.
- Apply practices of engineering design.
- Demonstrate digital literacy and good digital citizenship.
- Summarize properties of materials and chemistry applied in semiconductor fabrication.

Integrated High School Academics

N/A

Concurrent College Enrollment

TBD - Possible OCC ELM 102, ELM 101 (2 credits)

Equipment and Supplies

- **School will provide:** All tools including technology, equipment and supplies to complete projects
- **Student will provide:** N/A

Textbook

TBD

Grading

40% Classwork assignments including any quizzes/tests
60% Projects and presentations (rubric)

Additional Course Policies

Students are expected to:

- Meet all deadlines and be on time. Deadlines and being on time are a major part of being a professional.
- Produce their best work, including being prepared for presentations.
- Participate in class including contributing to discussions and critiquing their own and others' work, as well as diligently working on their own projects.
- Seek help when needed.
- Be attentive, ask questions if they do not understand something, and offer their opinions.
- Use Microsoft 365 and other identified technology hardware and software for preparing and sharing all work.
- Give credit and use proper citations for all research and project ideas.

Course Calendar

Quarter	Possible Driving Question/ Project	Units of Study
1	**How do semiconductors impact daily life?**	● Introduction to Class Expectations and Policies ● Introduction to Computer Chip Design and Production and Careers ● History of Semiconductor Development and Manufacturing ● Introduction to Programming ● Basic Safety in the Work Environment ● Applied Technical Math (Part 1)
2	**How has technology impacted drawing and planning?**	● Technical Drawing ● Introduction to Engineering Design ● Career Exploration
3	**What makes a good employee?**	● Digital Literacy ● Introduction to Material Science ● Career Exploration
4	**How can a creative experience help build understanding of a scientific process?**	● Materials and Process: Sand to Semiconductor ● Introduction to Photolithography ● Career Exploration and Reflection

Corcoran High School
Computer Chip Design and Production Pathway
Scope and Sequence
Level 1

First Quarter Project #1 Potential Driving Question: How do semiconductors impact daily life?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Introduction to Class Expectations and Policies **Introduction to Semiconductor Microchip Technology and Careers**	● What are the expectations for students in the Computer Chip Design and Production program? ● What is semiconductor microchip technology? ● What are different careers available in this field and what types of skills do they require? ● What are possible industry recognized certifications and the benefits of such certifications? ● What is the work environment like? ● What is a cleanroom? ● What are basic protocols for workers in a cleanroom? ● What are the financial and professional benefits of pursuing a career in this field? ● What is the typical career path for professionals? ● How is information gathered? ● How are questions formed to gather desired information?	● Develop classroom rules and establish relationships. ● Define semiconductor microchip technology. ● Identify several careers available in this field. ● Name key aspects or focus for careers in semiconductor Microchip Technology. ● Identify key skills, and traits required within this profession. ● Identify potential industry certifications and the benefits of obtaining such certification. ● Describe the cleanroom environment, providing an overview of the objectives and practices observed in such facilities. ● Explain what basic protocols workers in a cleanroom must follow (i.e., dress-bunny suit, personal care, interpersonal communication). ● Analyze typical earnings and benefits of a career in this field. ● Identify local, regional, and national employers. ● Name what education,	**Written** ● Self-Assessment ● Class Assignments ● Professional Portfolio ● Career Interest Survey ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1,4,10 **Cluster Standards** MN 4 ST 5 **Pathway Standards** MN-PPD 1	**ELA** 9-10 R 1,4 9-10 W 2,3,5 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6 **Literacy** 9-10 RST 2 9-10 WHST 3,4,5,6,7 **Math** **Science** **Computer Science and Digital Fluency**

First Quarter Project #1 Potential Driving Question: How do semiconductors impact daily life?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● What are student goals for career and learning outcomes? ● How is learning and experiences documented?	certifications and experiential requirements are for a selected career within this field. ● Create questions for inquiry for additional information. ● Demonstrate effective and reputable research skills to answer questions. ● Demonstrate effective communication skills to interview professionals to gather additional information. ● Identify personal goals for long-term career and short-term learning. ● Develop a professional portfolio including journal entries documenting individual learning.			
History of Semiconductor Microchip Technology	● How has the semiconductor industry developed and evolved? ● What were major milestones leading to the development of the semiconductor industry today? ● How are semiconductors used? ● What are the basic steps in the manufacturing process? ● What are the five key stages of the manufacturing process?	● Summarize an overall historical perspective of the semiconductor industry. ● Identify major milestones leading to current semiconductor Microchip Technology. ● Identify common uses for semiconductors. ● Summarize basic steps in the manufacture of a semiconductor. ● Identify key stages in the manufacturing process. ● Name materials used in semiconductor manufacture.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 4,7 **Cluster Standards** MN 1,4 ST 4 **Pathway Standards** MN-PPD 1 ST-SM 3	**ELA** 9-10 R 1,2,4 9-10 W 2,3,5 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6 **Literacy** 9-10 RST 2,4, 9-10 WHST 2,5,6,7 **Math** **Science** **Computer Science and Digital Fluency**

First Quarter Project #1 Potential Driving Question: How do semiconductors impact daily life?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● What materials are used in semiconductor processing? ● What are key terms and vocabulary? ● Why is a cleanroom integral for the manufacturing process?	● Identify and define key terms and vocabulary for semiconductor fabrication. ● Explain the importance of a cleanroom environment and protocols.			
Introduction to Programming	● What are previous experiences with coding and programming? ● What is the function of a micro-controller such as Raspberry Pi? ● What are applications of micro controllers? ● What are key differences between programming and scripting languages? ● How is a scripting language such as Python used with micro-controllers? ● How is a proficiency in a computer language demonstrated?	● Demonstrate and explain previous coding and programming experiences. ● Describe the function of a micro-controller. ● Describe applications for micro-controller. ● Compare and contrast programming and scripting languages and their applications. ● Demonstrate writing and executing of a scripting language such as Python to control and interact with micro-controller such as Raspberry Pi.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes **Performance** ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1,2,4,8,11	**ELA** 9-10 R 1,2 9-10W 2 9-10 SL 1,2,4,5 9-10L 1,2,3,4,6
				Cluster Standards ST 1,2	**Literacy** 9-10 RST 1,2,4,7 9-10 WHST 2
				Pathway Standards ST-ET 1,3	**Math**
					Science
					Computer Science and Digital Fluency
Basic Safety in the Work Environment: **(OCC ELM 102)**	● What are the causes and consequences of the most common types of workplace incidents? ● What are examples of job-site hazards? ● How is PPE used to protect workers from different types of injuries?	● Describe the causes and consequences of the most common types of workplace incidents. ● Describe common environmental hazards and how workers should respond to them.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes **Performance** ● Class Presentation ● Class Assignments	**Career Ready Practices** CRP 1	**ELA** 9-10 R 1,2 9-10 W 2 9-10 SL 1,2,3,4,5,6 9-10 L 1,4,6
				Cluster Standards MN 5	**Literacy** 9-10 RST 2,4 9-10 WHST 2,3

First Quarter Project #1 Potential Driving Question: How do semiconductors impact daily life?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● Why is it important to store materials and tools in their proper places? ● Where should hazardous materials be stored? ● How should chemicals be handled and labeled? ● What information can be found on a Safety Data Sheet? ● Why do fires have different classifications, and how does that impact response to a fire? ● What are the guidelines for the safe use of hand and power tools? ● Why should a power tool always be grounded? ● What is a tag out lock out procedure? ● How can a person protect themselves while lifting? ● Why is it important to be certified to administer first aid? ● What are basic first aid procedures? ● What are responses to chemical exposure? ● What is the role of the OSHA (Occupational Safety and Health Administration) in job-site safety? ● What benefits are associated with having	● Explain the benefits of safety, the cost of workplace incidents, and ways to reduce related hazards. ● Explain how and when PPE is used to protect workers from different types of injuries. ● Demonstrate the use and care of appropriate personal protective equipment. ● Demonstrate putting on and removal of bunny suits. ● Explain the importance of following safety protocols for the handling and storage of materials and tools. ● Identify safe handling, labeling and storage protocols for hazardous (chemicals) materials. ● Explain the importance of Safety Data Sheets (SDS). ● Interpret a SDS and summarize it. ● Identify the types of fires and the methods used to extinguish them. ● Identify common hand tools and demonstrate how to use them safely. ● Identify and explain how to use common power tools. ● Summarize basic power tool safety guidelines. ● Identify tag out lock out procedures for who has the key and whose name is on tag.	● Teacher Observation/ Checklist **Certification** ● OSHA 10 Hour	ST 3 **Pathway Standards** MN-MIR 2 MN-PPD 3 MN-PRO 2,5 MN-QA 5	**Math** **Science** **Computer Science and Digital Fluency**

First Quarter Project #1 Potential Driving Question: How do semiconductors impact daily life?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	the OSHA 10 Hour certification? ● Why is it important to follow reporting procedures? ● What are the steps that should be followed after an accident?	● Demonstrate lockout and tagout procedures for use with any equipment connected to power source. ● Define safe work procedures around electrical hazards. ● Compare and contrast safe and improper lifting techniques. ● Demonstrate positioning and techniques to prevent injury while lifting and carrying equipment. ● Explain the purpose of first aid. ● Locate first aid equipment and emergency numbers. ● Identify emergency first-aid procedures. ● Demonstrate application of standard first-aid procedures while following any school policies regarding administration of first aid and protections. ● Demonstrate, in a simulation, response to chemical exposure. ● Summarize the purpose of OSHA, why it was established and how it has evolved. ● Explain the role of the OSHA in job-site safety. ● Articulate the benefits of OSHA 10-hour certification to demonstrate safety skills to the industry.			

First Quarter Project #1 Potential Driving Question: How do semiconductors impact daily life?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		● Review the requirements of the OSHA 10-hour Safety certification. ● Explain the difference between compliance and best practices. ● Demonstrate proficiency in basic safety protocols through OSHA 10-hour certification. ● Articulate the importance of timely and accurate reporting of an incident. ● Justify any ethical considerations that might be involved in making a report that involves coworkers. ● Summarize when, to whom and what details need to be included for any report of personal injuries, environmental issues, and equipment safety violations to the appropriate authority.			
Applied (Technical) Math- Part 1	● How are whole numbers, fractions, decimals and percents related? ● How are fractions, decimals, and percents added, subtracted, multiplied, and divided? ● When might one need to convert a decimal to a percentage? ● When might one need to convert a fraction to a decimal or a decimal to a fraction?	● Compare and contrast the relationship between whole numbers, fractions, decimals and percents ● Calculate and solve problems with whole numbers, fractions, and decimals. ● Explain place value with whole numbers and decimals. ● Define equivalent fractions and calculate their lowest common denominators. ● Define improper fractions and convert them into mixed numbers.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes **Performance** ● Class Presentation ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 2 **Cluster Standards** MN 6 ST 2 **Pathway Standards** ST-ET 6	**ELA** 9-10 SL 1,2,3,4,5,6 9-10 L 1,4,6 **Literacy** 9-10 RST 7 **Math** **Science** **Computer Science and**

First Quarter Project #1 Potential Driving Question: How do semiconductors impact daily life?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● Why might it be easier to multiply a decimal rather than a fraction? ● What are the units in the metric system? ● When are conversions commonly used? ● How are micro units expressed? ● Why is accurate measurement critical? ● How are linear equations solved? ● When are equations used in fabrication of materials for semiconductors? ● Why is accuracy important?	● Convert decimals to percents and percents to decimals. ● Convert fractions to decimals and decimals to fractions. ● Demonstrate conversion of units to simplify math calculations. ● Define units in the metric systems. ● Demonstrate conversion from imperial to metric systems. ● Identify units used to express micro amounts. ● Justify why accurate measurement is important. ● Calculate and solve measurement problems with whole numbers, fractions and decimals. ● Demonstrate solving linear equations. ● Summarize how the use of linear equations may determine an unknown. ● Explain potential problems with inaccurate mathematical calculations.			**Digital Fluency**

Second Quarter Project #2 Potential Driving Question: How has technology impacted drawing and planning?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Technical Drawing **(OCC ELM 101)**	● What are different types of technical drawings? ● What is a schematic? ● What is the importance of scale? ● What are the basic electrical symbols used on plans? ● What are examples of diagrams used to program controls? ● How does a schematic guide development or installation? ● How does technology assist in creating drawings and plans? ● What is the difference between a schematic and line diagram?	● Identify basic technical drawing terms, abbreviations, components, symbols, and use of scale. ● Identify classifications of drawings such as civil, architectural, structural, mechanical, plumbing. ● Explain how dimensions relate to scale. ● Summarize the purpose of a schematic. ● Identify selected electrical symbols and abbreviations commonly used on plans. ● Demonstrate proficiency in interpreting electrical/electronic drawings or schematics. ● Translate schematic or drawing into written or oral explanation. ● Apply a schematic to install a basic device. ● Create a schematic incorporating legend, scale, and symbols. ● Explore the use of technology to support creation of drawings and plans. ● Demonstrate use of CAD to create and revise a schematic or plan.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes **Performance** ● Class Presentation ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 2,11 **Cluster Standards** MN 6 ST 2 **Pathway Standards** MN-PPD 1 ST-ET 2	**ELA** 9-10 R 1,2,4 9-10 W 2 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6 **Literacy** 9-10 RST 2,4,7 **Math** **Science** **Computer Science and Digital Fluency**

Second Quarter Project #2 Potential Driving Question: How has technology impacted drawing and planning?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Introduction to Engineering Design	● How does a problem lead to a design? ● What are core principles of engineering design? ● What is a design process? ● How are principles of design integrated? ● Why is it important to identify criteria and constraints? ● How are designs refined? ● How can a design be evaluated? ● What is a prototype? ● What is learned from a prototype? ● What are common methods for producing a prototype ● What is quality control? ● What are functional requirements? ● Why are designs tested and refined? ● Why should final solutions be re-evaluated? ● How do creators communicate their design for development and implementation? ● What are orthographic and isometric drawings? ● What is included in a bill of materials? ● What is the relationship between flow-process chart, operation-process chart, and operation sheet? ● Why is spatial reasoning important? ● What are differences between a SOP and an operation sheet?	● Identify examples of problems and resulting solutions or designs. ● Identify specific examples of core principles of design. ● Recognize the design process of analysis, research, selection and implementation and evaluation by use of a rendering, model, sketch. ● Summarize the purpose of defined criteria and constraints. ● Summarize how designs are evaluated and refined. ● Explain the purpose of prototypes. ● Summarize how prototypes are produced and tested. ● Explain why testing and refining a design is necessary. ● Explain the purpose of final evaluation. ● Explain how designs are communicated through drawings, schematics, and models. ● Compare and contrast orthographic and isometric drawings. ● Identify what is included in a bill of materials. ● Compare and contrast flow-process chart,	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Project ● Class Presentation ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1,4,5,6,7,8,12 **Cluster Standards** MN 6 ST 1,2 **Pathway Standards** MN-PRO 1,3,4	**ELA** 9-10 R 1,2,4 9-10 W 2,5 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6 **Literacy** 9-10 RST 2,3,4,7 9-10 WHST 2 **Math** **Science:** **Computer Science and Digital Fluency**

Second Quarter Project #2 Potential Driving Question: How has technology impacted drawing and planning?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment** **Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● What are examples of design with semiconductors? ● How has technology impacted the design process? ● Why is the engineering design process used? ● How is the design process implemented? ● How is a concept moved from design to production?	operation-process chart, and operation sheet. ● Explain how spatial reasoning supports the design process. ● Explain the information provided by SOP (Standard Operating Procedures) and an operation sheet. ● Compare and contrast examples of designs within the semiconductor field. ● Describe how Computer Aided Design, 3-D printing and automation impact the design process. ● Describe how the engineering design process is a loop that is a systematic, creative process for solving problems. ● Apply engineering design process by identifying a problem, developing an idea, documenting planning, and creating a prototype or model. ● Demonstrate planning for production by creating working drawings, bill of materials, standards operation procedure and other planning documents. ● Demonstrate integration of the engineering design process by creating an			

Second Quarter Project #2 Potential Driving Question: How has technology impacted drawing and planning?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment** **Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		original design, creating a prototype, and evaluating it.			
Career Exploration	● What skills and traits do I have that are an asset for this field? ● Why might manual dexterity be important in this field? ● What additional information is required to know regarding the work environment, daily tasks and application of skills and knowledge? ● What does professional communication look and sound like?	● Summarize skills and traits that are essential for this field. ● Synthesize personal skills and traits. ● Explain why manual dexterity and fine motor control are important in this field. ● Demonstrate using professional communication (spoken and written) skills to interact with professionals in this field. ● Report on key learning from professionals in the field regarding work environment and daily tasks.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection ● Professional Portfolio **Performance** ● Class Presentation ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1,4,7,10	**ELA** 9-10 R 1 9-10 W 2,3 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6
				Cluster Standards MN 4 ST 5	**Literacy** 9-10 WHST 3,4
				Pathway Standards	**Math**
					Science
					Computer Science and Digital Fluency

Third Quarter Project # 3 Potential Driving Question: What makes a good employee?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Digital Literacy	● Why is digital citizenship important? ● What does it mean to be a good digital citizen? ● How can students be safe and secure when using online applications? ● How can the validity of a source be verified? ● What software tools are commonly used? ● How can a web search be optimized? ● How does word processing provide efficiency? ● What is a spreadsheet? ● What is a database? ● How does technology support communication? ● How does technology support research? ● How can technology support a presentation? ● What are key components and functions of computing systems? ● How does networking support advances in technology? ● What are types of network topologies, how do they connect and how is security maintained? ● How do networks connect? ● What are common troubleshooting protocols when connecting networks? ● How do connected networks support daily communication,	● Summarize the role of technology in society. ● Explain the need for and demonstrate good digital citizenship, cyber safety, and security protocols. ● Describe how to protect yourself online, including verifying someone's online identity, verifying that a link is safe, and identifying online scams. ● Demonstrate safety in personal use and information when using technology. ● Explain the ways that people can protect their personal privacy online. ● Identify ways to recognize and stop cyberbullying. ● Summarize strategies to check validity of internet sources. ● Demonstrate effective use of keywords/terms for internet searches. ● Demonstrate efficient use of word processing. ● Demonstrate productive use of a spreadsheet. ● Interpret a database. ● Demonstrate proficiency in technology tools by obtaining Microsoft certification in Word and Excel.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist **Certification:** ● Microsoft Word ● Microsoft Excel	**Career Ready Practices** CRP 1,4,7,9,11 **Cluster Standards** MN 1 ST 2 **Pathway Standards** MN-PPD 1 MN-PRO 1,4 ST-ET 2	**ELA** 9-10 R 1,2,4 9-10 W 2 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6 **Literacy** 9-10 RST 1,2,4,7 **Math** **Science** **Computer Science and Digital Fluency**

Third Quarter Project # 3 Potential Driving Question: What makes a good employee?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment** **Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	data collection and advanced manufacturing?	● Demonstrate use of computer software tools for planning, researching, communication, and documentation. ● Demonstrate use of technology and visuals to support a presentation. ● Describe key components and functions of a computing system. ● Explain benefits and value of networking systems. ● Identify varied network topologies, protocols and how connections are established. ● Describe measures for security across devices and systems. ● Demonstrate establishment of a small network ● Demonstrate resolving connectivity issues through troubleshooting. ● Summarize how connected networks enhance productivity.			
Introduction to Material Science	● What materials are used in semiconductor fabrication and manufacturing? ● What are the differences between metals and nonmetals? ● What are the properties of materials used in silicon wafer production? ● How does a crystal grow?	● Identify raw materials utilized for semiconductor fabrication. ● Compare and contrast metals and nonmetals. ● Summarize properties of materials. ● Demonstrate how a crystal grows.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments	**Career Ready Practices** CRP 2 **Cluster Standards** MN 6	**ELA** 9-10 R 1,2,4 9-10 W 2 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6 **Literacy** 9-10 RST 2,4,6,7 9-10 WHST 2,4,5

Third Quarter Project # 3 Potential Driving Question: What makes a good employee?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● Why is a clean environment so important? ● How are materials sourced? ● What are considerations for materials utilized?	● Explain the role of a cleanroom and the impact of contamination. ● Summarize how raw materials are sourced and prepared. ● Summarize possible economic, scientific, social, and global climate impacts for different materials.	● Teacher Observation/ Checklist	**Pathway Standards** MN-QA 1	**Math** **Science** **Computer Science and Digital Fluency**
Career Exploration and Employability	● What does it mean to be a professional? ● When is attending to personal social media and calls appropriate? ● Why is punctuality important? ● What is the importance of good communication? ● What is the importance of critical thinking in solving problems? ● Why is resilience an important skill in the semiconductor industry? ● Why are good social skills necessary ● What is the importance of teamwork? ● How are tasks prioritized and completed in a timely fashion? ● What are some important social issues of concern in the workplace?	● Discuss professional standards and employability skills, including the role of an employee in the semiconductor industry. ● Demonstrate use of personal devices for social media and call only during breaks and allotted times. ● Explain the importance of punctuality. ● Demonstrate good attendance and punctuality to class. ● Describe the communication process and the importance of listening and speaking skills and their relationship to job performance. ● Describe the importance of good reading and writing skills and their relationship to job performance. ● Communicate effectively using verbal and writing skills.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1,4,8,9,10 **Cluster Standards** MN4 ST 5 **Pathway Standards**	**ELA** 9-10 R 1,4 9-10 W 2,3 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6 **Literacy** 9-10 RST 2 9-10 WHST 3,4 **Math** **Science** **Computer Science and Digital Fluency**

Third Quarter Project # 3 Potential Driving Question: What makes a good employee?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		● Communicate effectively on the job using electronic communication devices. ● Explain the importance of critical thinking in solving problems. ● Explain the importance of resilience in solving problems and adapting to changes as they arise. ● Explain the importance of social skills and identify ways good social skills are applied in a professional environment. ● Describe how to work in a team environment and how to be an effective leader. ● Explain how to resolve conflicts with co-workers and supervisors. ● Explain how to give and receive constructive criticism. ● Demonstrate prioritization of tasks and time to complete tasks within deadlines. ● Identify and describe various social issues of concern in the workplace.			

Fourth Quarter Project #4 Potential Driving Question: How can a creative experience help build understanding of a scientific process?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Materials and Process: Sand to Semiconductor	● What is sand made of? ● How is polysilicon sourced? ● What is the chemical makeup of silicon? ● Why is silicon used? ● What is an ingot? ● How does an ingot become a wafer? ● How is a wafer handled? ● What is oxidation? ● How is a wafer cleaned? ● How is a wafer finished? ● What is lapping and why might that need to be done to a wafer? ● What is doping? ● How does doping change the structure of material? ● What is the relationship between doping methods and electrical conduction? ● What is the purpose of etching? ● What is a transistor? ● How are transistors laid down on a wafer? ● What is a gate? ● How do electrons bond? ● What is the role of boron and phosphorus? ● How are electrons harnessed to create a circuit? ● What is a photomask? ● How are circuits designed (photolithography)? ● What testing needs to occur? ● What is packaging? ● What is the range of sizes of wafers, transistors and semiconductors?	● Identify the chemical make-up of sand. ● Summarize how polysilicon is obtained. ● Identify the chemical makeup of silicon. ● Explain how the structure of silicon supports the fabrication of integrated chips (IC)/semiconductor chips. ● Explain the Czochraisk method and what mediums are ideal for crystal growth. ● Define ingot. ● Explain the steps transforming an ingot to a wafer. ● Describe how wafers are handled. ● Explain how a wafer is cleaned after cutting. ● Explain how a wafer is finished. ● Explain the process and purpose of doping. ● Explain the process of lapping. ● Define oxidation. ● Explain etching process and purpose. ● Explain what a transistor is. ● Explain how transistors are laid down. ● Explain the purpose of a gate.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1,2,7 **Cluster Standards** MN 6 ST 1 **Pathway Standards** MN-PPD 1,2,3,4,5	**ELA** 9-10 R 1,2,4 9-10 W 2,5,6,7 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6 **Literacy** 9-10 RST 1,2,4 9-10 WHST 2,5 **Math** **Science** **Computer Science and Digital Fluency**

Fourth Quarter Project #4 Potential Driving Question: How can a creative experience help build understanding of a scientific process?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● What is the role of acids and bases in fabrication of semiconductors? ● What are specific precautions for safe handling of chemicals utilized in this process?	● Explain how a transistor is both a conductor and insulator. ● Summarize how electrons bond. ● Explain what the impact of treatment with boron or phosphorus is. ● Explain what a photo mask is and what it does. ● Explain the photolithography process. ● Explain how etching removes unnecessary materials. ● Summarize how wafers are tested. ● Explain how wafers are packaged or cut into semiconductors. ● Identify range of sizes of transistors, and semiconductors. ● Summarize the effect of bases and acids throughout the semiconductor process. ● Explain specific precautions for working around chemicals and chemical processes during Computer Chip Design and Production.			
Introduction to Photo-lithography	● What is lithography? ● What is photolithography? ● How is the process of traditional photo development of coat,	● Describe lithography. ● Describe the process of photolithography.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection	**Career Ready Practices** CRP 1,2,4,6,8,12	**ELA** 9-10 1,2,4 9-10 W 2,4 9-10 SL 1,2,3,4,5,6

Fourth Quarter Project #4 Potential Driving Question: How can a creative experience help build understanding of a scientific process?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	develop and expose accomplished? ● How is photolithography and lithography and photography alike and different? ● What is the role of light? ● What is a photomask?	● Describe traditional photography development of prints. ● Compare and contrast processes, chemicals, and procedures for photolithography, lithography and traditional photography. ● Compare and contrast the effect of light and how light is controlled for outcomes. ● Identify tools, and key terms for photolithography. ● Demonstrate the process of coating, developing and exposure to create a product. ● Explain how a photomask supports development of a chip.	**Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist ● Project		9-10 L 1,2,4,6
				Cluster Standards MN 6	**Literacy** 9-10 RST 1,2,4 9-10 WHST 2,4
				Pathway Standards MN-PPD 1	**Math**
					Science
					Computer Science and Digital Fluency
Career Exploration and Reflection	● What aspects of a career or role is of interest within this field? ● What are specific requirements for a career of interest? ● How might personal goals need to be revised? ● How is learning and skill acquisition documented?	● Articulate possible careers to aspire towards. ● Identity skills, traits, education and experiences aligned with a career of interest. ● Articulate goals, accomplishments, and revisions. ● Communicate skills and knowledge through employability profile, resume and portfolio. ● Document credentials earned.	**Written** ● Self-Assessment ● Class Assignments ● Written Reflection ● Professional Portfolio **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 10	**ELA** 9-10 R1,4 9-10 W 3 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6
				Cluster Standards MN 4 ST 5	**Literacy** 9-10 WHST 3,4
				Pathway Standards	**Math**
					Science
					Computer Science and Digital Fluency

Corcoran High School
Computer Chip Design and Production Pathway
Course Syllabus
Level 2

Pathway Overview

This 4-year sequence of Computer Chip Design and Production courses will prepare students to enter the field of high technology fabrication. Students will be poised to enter the industry directly as a technician, or continue their education to obtain an associate's degree in electromechanical, mechatronics or semiconductor microchip technology. Within this pathway students will explore career possibilities through research, field visits and professional mentoring. Students will obtain safety certification to work in an industrial setting, be able to apply background information in physics, chemistry, and math to understand the fabrication process and to trouble-shoot processes and machines. Students will have a solid background in applied electrical theory and clean laboratory protocols. Students will demonstrate their skills as technical readers and writers and demonstrate professional communication skills. Students will balance individual skills with group development skills including collaboration, communication, critical thinking, creativity, problem solving, perseverance, information literacy, technology skills, and digital literacy. They will develop awareness of motivating and supporting others including an awareness of diversity, ethical and professional practices. Students will have opportunities to pursue certifications including, but not limited to: OSHA 10, Microsoft Word and Excel, receive 18-24 college credits and other industry certifications demonstrating their knowledge and career readiness for this field.

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Course Description

For the second year, students continue to build foundational skills and career ready practices. Technical skills and background knowledge include applied physics, refrigeration, and the creation and maintenance of a vacuum environment. Student use and care of specialized tools and how to read and interpret various gauges is a focus. Introduction to industrial electricity lays the groundwork for units in motors and controls, circuits, and logic gates. The second part of technical math continues to build skills for calculations involving algebra, geometry, and trigonometry. Taking and interpreting precision measurement is included. Career exploration and building their identity is incorporated throughout the year.

All students will engage in project-based learning at a minimum of a project each quarter. Intrinsic to project-based learning is to examine a driving question or identify a problem by articulating what is already known, and what students need to know to answer the question. Students are guided to develop and execute a plan culminating in a presentation or product demonstrating their response to the initial question or problem. This process concludes with self-reflection regarding their learning. As such, learning happens during project execution and not solely as a final activity to show learning.

Work-Based Learning

Students will be connected with local and national employers and industries throughout their learning experiences especially as they complete project-based learning experiences. These professional connections may include interviews, field trips to local businesses, job shadowing and career coaching. It is expected that these experiences will lead to opportunities for direct job training and real-world experience. Students will create and maintain a portfolio of their experiences to document the development of their skills, including a professional resume.

Additional Learning Opportunities

- **Micro-credentials:** Students may pursue learning experiences and credentials depending on the requirements of the project that they are involved in. Some examples for this pathway include, but are not limited to:
    - Microsoft Office Specialist: Word Associate
    - Microsoft Office Specialist: Excel Associate
    - OHSA 10 Hour
    - Other Industry certifications such as such as CISCO, CompTIA and others

- **Summer Bridge Enrichment:** Students will have the opportunity to participate in cross-curricular Summer Bridge programs to enhance and enrich their skills. Students will explore and create solutions that address authentic needs in the school and wider community with the involvement of local industry professionals. Students will build on skills learned during the school year to work collaboratively with students from other pathways and programs.

Pre-Requisites

Computer Chip Design and Production Level 1

Course Objectives

Upon completion of the course students will know and be able to:

- Demonstrate application of safety protocols
- Explain the function of a clean room and demonstrate preparation to work in a clean room.
- Explain the role of light in testing materials.
- Explain the basics of refrigeration and commercial applications for manufacturing.
- Apply appropriate mathematical concepts to solve applied linear algebra, basic geometry and basic right triangle trigonometric problems.
- Demonstrate proficiency taking and interpreting precision and semi-precision measurements.
- Demonstrate use and care of hand and power tools.
- Demonstrate use and care of precision measurement tools.
- Demonstrate safety protocols in industrial settings, recognizing hazards and taking appropriate precautions to work in a safe manner with electrical current.
- Explain how electricity is harnessed and converted into mechanical energy.
- Demonstrate operation and troubleshooting with motors and controls.
- Explain function of circuits and logic gates.
- Explain the creation, purpose and maintenance of a vacuum.
- Identify careers of interest.

Integrated High School Academics

N/A

Concurrent College Enrollment

TBD- Possible OCC ELM 104, ELM 106, MAT 103 (total 6 credits)

Equipment and Supplies

- **School will provide:** All tools including technology, equipment and supplies to complete projects
- **Student will provide:** N/A

Textbook

TBD

Grading

40% Classwork assignments including any quizzes/tests
60% Projects and presentations (rubric)

Additional Course Policies

Students are expected to:

- Meet all deadlines and be on time.
- Deadlines and being on time are a major part of being a professional.
- Produce their best work, including being prepared for presentations.
- Participate in class including contributing to discussions and critiquing their own and others' work, as well as diligently working on their own projects.
- Seek help when needed.
- Be attentive, ask questions if they do not understand something, and offer their opinions.
- Use Microsoft 365 and other technology tools for preparing and sharing all work.
- Give credit and use proper citations for all research and project ideas.

Course Calendar

Quarter	Driving Question/ Project	Units of Study
1	**What may be impacts of a clean room facility and protocols on working environment?**	● Class Expectations and Policies ● Safety Review ● Clean Room - Protocols and Etiquette ● Light ● Refrigeration Background ● Career Exploration
2	**How can you use equations to solve real-world problems?**	● Applied Technical Math- Geometry, Right Angle Trigonometry, Precision Measurements ● Tools and Gauges ● Theory of Electricity-Part 1 ● Career Exploration
3	**How do parts contribute to make a system?**	● Theory of Electricity-Part 2 ● Motor and Controls ● Circuits
4	**How do scientific discoveries and advances impact manufacturing?**	● Logic Gates ● Vacuum- What, Why and How ● Career Exploration and Reflections

Corcoran High School
Semiconductor Pathway
Scope and Sequence
Level 2

First Quarter Project #1 Potential Driving Question: What may be the impacts of a cleanroom facility and protocols on the working environment?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Class Expectations and Policies **Safety Review**	● What are the expectations for students in the Computer Chip Design and Production program? ● What are key safety concepts? ● How is basic first aid administered? ● Why is a SDS (Safety Data Sheet) important? ● How is safety maintained in a job-site or lab?	● Develop classroom rules and establish relationships. ● Articulate goals towards a career of choice. ● Demonstrate use of basic first aid. ● Demonstrate proper use and care of PPE and tools (hand and power). ● Complete a SDS form. ● Complete an accident report. ● Demonstrate in daily practice safety protocols such as identifying and mitigating potential hazards and unsafe practices.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1,3 **Cluster Standards** MN 5 ST 3 **Pathway Standards** MN-MIR 2 MN-PPD 3 MN-PRO 2,5 MN-QA 5	**ELA** 9-10 R 1,4 9-10 W 2 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6 **Literacy** 9-10 RST 1,2 9-10 WHST 2 **Math** **Science** **Computer Science and Digital Fluency**
Cleanroom: Protocols and Etiquette	● Why is a cleanroom utilized in integrated chips fabrication including semiconductor Microchip Technology? ● What makes a cleanroom clean? ● How is a cleanroom entered and exited? ● Why are negative pressure locks utilized? ● How is a cleanroom maintained to be clean? ● How might dressing and grooming be different for a	● Summarize the purpose for a cleanroom environment for specific manufacturing applications. ● Summarize criteria for a cleanroom. ● Describe how to enter and exit a cleanroom. ● Explain how negative pressure helps maintain a cleanroom environment. ● Explain protocols and procedures to maintain a	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1,3,5 **Cluster Standards** MN 3,5 **Pathways Standards** MN-PRO 2,4,5	**ELA** 9-10 R 1,2,4 9-10 W 2,3,5 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6 **Literacy** 9-10 RST 1,2,4 9-10 WHST 2 **Math** **Science**

First Quarter Project #1 Potential Driving Question: What may be the impacts of a cleanroom facility and protocols on the working environment?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	technician in a cleanroom environment? ● What is allowable in a cleanroom? ● How do technicians communicate with each other? ● What might make working in a cleanroom environment challenging?	cleanroom environment. ● Describe dress and grooming protocols. ● Summarize what objects may and may not be carried into a cleanroom environment. ● Explain how communication is carried out. ● Research and summarize what practicing technicians identify as challenges and how they adapt to those challenges within a cleanroom environment.			**Computer Science and Digital Fluency**
Light	● What is the light spectrum? ● What is the electromagnetic spectrum? ● What is a spectrometer? ● What does a spectrophotometer measure? ● What does the information gathered tell? ● How does information about light and electromagnetic spectrums help find impurities in metals?	● Define the light spectrum. ● Define electromagnetic spectrum. ● Identify a spectrometer. ● Identify a spectrophotometer. ● Demonstrate reading of a spectrometer and spectrophotometer. ● Interpret information from readings. ● Describe how the light and wave frequency provide information.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 2	**ELA** 9-10 R 1,2,4 9-10 W 2 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6
				Cluster Standards MN 6	**Literacy** 9-10 RST 2 9-10 WHST 2
				Pathway Standards MN-QA 1	**Math** **Science** **Computer Science and Digital Fluency**
Refrigeration Background	● How does refrigeration work? ● What components make up a refrigeration system? ● What are refrigerants?	● Explain the process of refrigeration. ● Identify components within a refrigeration system.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection	**Career Ready Practices** CRP 2	**ELA** 9-10 R 1,2,4 9-10 W 2 9-10 SL 1,2,3,4,5,6

First Quarter Project #1 Potential Driving Question: What may be the impacts of a cleanroom facility and protocols on the working environment?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● What is the environmental impact of refrigerants? ● What are current regulations regarding type and use of refrigerants? ● What are different types of refrigeration systems? ● How is refrigeration used in manufacturing?	● Explain the purpose of refrigerants. ● Discuss the impact of refrigerants on the environment and global warming. ● Identify current regulations regarding use of refrigerants. ● Name uses of commercial refrigeration in manufacturing and other processes.	**Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist		9-10 L 1,2,4,6
				Cluster Standards MN 6	**Literacy** 9-10 RST 2 9-10 WHST 2
				Pathway Standards	**Math**
					Science
					Computer Science and Digital Fluency
Career Exploration	● What are different careers available in semiconductor fabrication and what types of skills do they require? ● What are the financial and professional benefits of pursuing a career in this field? ● What is the typical career path for varied positions within this field? ● What are personal learning goals towards a career? ● What might be some challenges to working in a cleanroom? ● How is diversity encouraged and respected? ● What skills and traits make a good employee? ● What makes a career a good fit?	● Identify different careers available in semiconductor fabrication and the types of skills they require. ● Summarize the current and future outlook for jobs. ● Describe the financial and professional benefits of pursuing a career in this field. ● Describe varied paths depending on career focus such as engineer, technician, supporting trades or supporting general labor or business. ● Identify different ways to pursue a career in semiconductor fabrication. ● Describe an area of interest in semiconductor fabrication and investigate its entry-level requirements, and its growth potential.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 3,10	**ELA** 9-10 R 1 9-10 W 2,3,5 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6
				Cluster Standards MN 4 ST 5	**Literacy** 9-10 RST 2,6 9-10 WHST 2,3,4,5
				Pathway Standards	**Math**
					Science
					Computer Science and Digital Fluency

First Quarter Project #1 Potential Driving Question: What may be the impacts of a cleanroom facility and protocols on the working environment?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment** **Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		● Articulate goals towards a career of choice. ● Identity challenges for working in a cleanroom environment and how professionals adapt to those challenges. ● Summarize ways that diversity is encouraged in this field. ● Demonstrate awareness and respect towards peers. ● Demonstrate traits such as respect, attendance, punctuality, time management, use of personal devices, and time management. ● Articulate ways that personal traits, skills, and interest impact success in a career.			

Second Quarter Project #2 Potential Driving Question: How can you use equations to solve real-world problems?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Applied (Technical) Math-Part 2 **(Completes OCC MAT 103)**	● What does order of operations refer to? ● How are math calculations applied to find information? ● How are units converted? ● How are micro units expressed ● How does engineering notation, including power of ten, prefixes and symbols, simplify communication? ● How are units converted within a metric system? ● What is the purpose of conversions within a metric system? ● What are the properties of a circle? ● What are the properties of a triangle? ● How are measurements of perimeter, area and volume determined? ● How do properties of right angles support calculations? ● What is precision measurement? ● What are measures of central tendency? ● What is standard deviation? ● How are precision and semi precision measurements taken? ● What tools are used for semi-precision measurement ● What tools are used for precision measurement? ● Why is accuracy and precision important in measurement?	● Demonstrate calculation of linear algebraic expressions by applying correct order of operations. ● Calculate and solve measurement problems with whole numbers, fractions, percentages, ratios and decimals. ● Demonstrate conversion of units to simplify math calculations. ● Identify units used to express micro amounts. ● Interpret engineering notation. ● Demonstrate use of engineering notation (powers of ten, prefixes and symbols). ● Explain how communication can be more efficient depending on notation and expressions. ● Demonstrate conversions. ● Name geometric properties of the circle. ● Name properties of a triangle. ● Demonstrate application of circle and triangle properties to solve for unknown information. ● Demonstrate determining perimeter, area, and volume.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 2 **Cluster Standards** MN 6 ST 2 **Pathway Standards** ST-ET 6	**ELA** 9-10 R 1,4 9-10 SL 1,2,3,4,5,6 9-10 L 1,4,6 **Literacy** 9-10 RST 7 **Math** **Science** **Computer Science and Digital Fluency**

Second Quarter Project #2 Potential Driving Question: How can you use equations to solve real-world problems?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● How can algebra, geometry and trigonometry be applied to determine unknown information?	● Apply right triangle trigonometry to demonstrate understanding of the relationship between side lengths, angle measures, and trigonometric ratios in right triangles. ● Demonstrate use of right-angle trigonometry to solve for unknown information. ● Identify and calculate measures of central tendency. ● Define standard deviation. ● Justify acceptable margins of error. ● Identify tools for precision measurements such as straight edges, pin/plug gages, gage blocks, surface plates, solid squares, micrometers, calipers, height gages, and others. ● Identify tools for semi precision measurement such as rules/scales, adjustable squares, and protractors. ● Compare and contrast precision and semi precision measurement. ● Demonstrate taking precision and semi precision measurements.			

Second Quarter Project #2 Potential Driving Question: How can you use equations to solve real-world problems?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment** **Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		● Summarize the importance of accuracy and precision in taking measurements. ● Demonstrate application of basic algebra, geometry, and trigonometry to solve for unknown information.			
Tools and Gauges **(OCC ELM 106)**	● What are basic hand tools? ● How are basic hand tools used? ● What is the difference between metric and standard tools? ● What are hand power tools? ● How are power tools used? ● What are examples of automated tools? ● What are tools used for precision measurements? ● How are precision tools handled and cared for? ● Why is precision measurement important? ● How is the correct tool for measurement selected? ● How are precision measurements expressed? ● How is information from gauges interpreted? ● How is temperature measured with a thermocouple?	● Identify basic hand tools such as allen wrench, torque wrench, hex wrench, sockets, pliers, clamping devices, screwdrivers, chisels, saws, soldering, wire cutters, connectors, etc. ● Demonstrate safe use of basic hand tools especially pliers and torque wrench. ● Identify metric and standard tools. ● Demonstrate correct use of either a metric or standard tool. ● Identify basic power tools. ● Demonstrate safe use and care of power tools. ● Demonstrate use of hand tools and basic hand held power tools to make common repairs. ● Summarize uses and application of automated tools. ● Identify tools for measurement such as levels, scales, feeler gauges, thread pitch gauges, calipers,	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 2 **Cluster Standards** MN 5 ST 3 **Pathway Standards** MN-MIR 2 MN-PPD 3 MN-PRO 2,5 MN-QA 5	**ELA** 9-10 R 1,2,4 9-10 W 2 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6 **Literacy** 9-10 RST 7 9-10 WHST 2 **Math** **Science** **Computer Science and Digital Fluency**

Second Quarter Project #2 Potential Driving Question: How can you use equations to solve real-world problems?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		micrometers, dial indicators, protractors, parallels and gauge blocks, precision straightedges and rulers. ● Demonstrate safe, and responsible handling and care of precision measurement tools. ● Demonstrate use of precision measurement tools. ● Explain the importance of precision measurement. ● Demonstrate proficiency in expressing measurements in imperial and metric systems. ● Match precision measurement tool to given task. ● Demonstrate taking and expressing precision measurements. ● Interpret information from a gauge and measurement reading. ● Explain how a thermocouple works. ● Demonstrate use of a thermocouple.			
Theory of Electricity- Part 1	● What are some common safety concerns working in an environment with electrical hazards? ● What are considered safe working conditions and safe work habits?	● Explain safe working practices around electrical hazards (e.g., grounding, using ground-fault circuit interrupters [GFCIs] and cords).	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation	**Career Ready Practices** CRP 1,2, **Cluster Standards**	**ELA** 9-10 R 1,2,4 9-10 W 2 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6 **Literacy**

Second Quarter Project #2 Potential Driving Question: How can you use equations to solve real-world problems?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● How does electric shock happen? ● What purpose do ground wires serve? ● What is the importance of ground fault circuit interrupters? ● Why is awareness of conductors and insulators important for safe practices? ● What is electricity?	● Identify equipment used to test electrical circuits. ● Demonstrate safe work habits including ways to protect yourself from electric shock. ● Explain how ground fault circuit interrupters work. ● Compare and contrast the purpose of conductors and insulators. ● Explain the flow of electrons creating electricity.	● Class Assignments ● Teacher Observation/ Checklist	MN 3,6	9-10 RST 1,2,4,7 9-10 WHST 2
				Pathway Standards MN-MIR 2 MN-PPD 3 MN-PRO 1,2,3 ST-ET 6	**Math**
					Science
					Computer Science and Digital Fluency
Career Exploration	● What can be learned from industry professionals?	● Participate in Career Coaching experience. ● Participate in the Job Shadowing process with local professionals.	**Written** ● Self-Assessment ● Written Reflection **Performance** ● Class Presentation	**Career Ready Practices** CRP 10	**ELA**
				Cluster Standards MN 4 ST 5	**Literacy** 9-10 WHST 3
				Pathway Standards	**Math**
					Science
					Computer Science and Digital Fluency

Third Quarter Project #3 Potential Driving Question How do parts contribute to form a system?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Theory of Electricity- Part 2 **(OCC ELM 104)**	● What are the two types of current? ● What is the difference between AC and DC? ● What are the benefits and drawbacks of AC and DC power? ● Why is AC used to distribute most of the utility power in the world? ● How fast does the voltage fluctuate and how does that compare to other places in the world? ● What is RMS (Root Mean Square)? ● What is a multimeter? ● What are key terms used in measurement of current? ● What is Ohm's Law? ● How is Ohm's Law calculated? ● How is Ohm's Law applied? ● What are some limitations of Ohm's Law? ● How can unknown information be determined through application of Ohm's Law? ● What is Watts Law? ● What are Kirchhoff's two laws? ● What is the relationship between these laws and watts, volts, amperage, and ohms? ● How can power be calculated by applying Ohm and Kirchhoff's Laws? ● What is a node? ● What is a circuit? ● What are types of circuits?	● Compare and contrast alternating current (AC) with direct current (DC) including how the current flows, applications, benefits, and drawbacks of each. ● Explain why AC is predominately used. ● Explain variations in voltage fluctuations in AC current and how that compares globally. ● Describe how RMS is the amount of AC power that produces the same heating effect as DC power. ● Demonstrate use of a multimeter to read a RMS value. ● Define amperage, volts, current, resistance ● Define Ohm's Law. ● Explain what information Ohm's law provides. ● Describe non-Ohmic materials such as diodes, transistors. ● Demonstrate computation of current, resistance or voltage using Ohm's Law. ● Define Watts Law. ● Explain what information Watts Law provides. ● Define Kirchhoff's current law (KCL) and Kirchhoff's voltage law (KVL).	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1,2, **Cluster Standards** MN 3,6 **Pathway Standards** MN-MIR 2 MN-PPD 3 MN-PRO 1,2,3 ST-ET 6	**ELA** 9-10 R 1,2,4 9-10 W 2 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6 **Literacy** 9-10 RST 1,2,4,7 9-10 WHST 2 **Math** **Science** **Computer Science and Digital Fluency**

Third Quarter Project #3 Potential Driving Question How do parts contribute to form a system?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● How does electricity move through a circuit? ● How do an open and closed circuit differ? ● How do series and parallel circuits differ? ● What is the formula for calculating a series circuit? ● What is the formula for calculating a parallel circuit? ● What measuring devices enable these calculations? ● What are basic components for working with electrical circuits? ● What role does a conductor and insulator have in electricity? ● What are 4 elements of a simple circuit? ● What is the purpose of a voltage regulator? ● How might voltage drop or increase in circuit? ● What accounts for voltage source and drop in a circuit ● What are the 3 types of power supply? ● What does a transformer do? ● What is the function of a capacitor? ● What are pilot devices? ● What is a control relay? ● What tools are used as measurement devices for resistance, voltage and current? ● What is the purpose of a function generator? ● How can connection to a DC power supply be done safely?	● Demonstrate application of power formulas and calculations. ● Define a node. ● Describe current flowing into a node and current flowing out. ● Explain positive and negative terminals. ● Define circuit. ● Identity types of circuits (open, closed, series, parallel). ● Compare and contrast an open and closed circuit. ● Compare and contrast series and parallel circuits. ● Demonstrate use of volt and amp meters on parallel and series circuits. ● Identify and explain the function of conductors, insulators, resistors, capacitors, inductors. ● Identify power source, conductor, switch, and load as elements of a circuit. ● Describe how a voltage regulator creates and maintains fixed output of voltage. ● Describe voltage sources and voltage drops in a circuit loop. ● Identity 3 types of power supply as linear, switched and battery based.			

Third Quarter Project #3 Potential Driving Question How do parts contribute to form a system?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment** **Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● What information do schematics and wiring diagrams provide? ● What are common areas to check for failures in systems? ● Why might mathematical and measurement calculations differ?	● Compare and contrast power sources of linear, switched and battery based. ● Explain how a transformer can increase or decrease voltage of AC by electromagnetic induction to transfer energy from 1 circuit to another. ● Describe the function of a capacitor to store energy and give examples. ● Identity examples of pilot devices such as push buttons, selector switches, toggle, and rover switches, and indicating lights. ● Describe the function of a control relay to allow electrical current to flow through a conducting coil to open and close a circuit. ● Demonstrate troubleshooting control relays. ● Explain why a function generator might be needed. ● Identity digital multimeter, oscilloscope, and function generator as tools for measurement. ● Demonstrate use of digital multimeter, oscilloscope, and function generators as testing tools to troubleshoot an issue.			

Third Quarter Project #3 Potential Driving Question How do parts contribute to form a system?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment** **Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		● Demonstrate assembly and testing to a DC power supply. ● Interpret a schematic or wiring diagram. ● Demonstrate following a schematic or wiring diagram. ● Demonstrate application of tools and background knowledge to troubleshoot a failure in a system. ● Demonstrate use of manual formulas, and specific calculators and measurement devices reconciling any differences.			
Motors and Controls	● What is a single-phase motor? ● What is a 3-phase motor? ● What are some of the differences in operation and applications of a single and 3-phase motor? ● How does a DC motor differ from an AC motor? ● What are some applications for use of a DC motor? ● How does a stepper motor work? ● What type of motor uses brushes and what are the benefits or drawbacks? ● How can the operation of a motor be enhanced? ● What is the advantage of a servo motor? ● What are the differences among unipolar, bipolar, and universal stepper motors?	● Describe single-phase motors and their operation. ● Describe a 3-phase motor. ● Compare and contrast single and 3-phase motors in regards to operation and application. ● Describe the operation of a DC motor. ● Describe applications for use of a DC motor. ● Compare and contrast DC and AC motors. ● Explain the operation and purpose of a stepper motor. ● Identity types of motors that use brushes and what the advantages are for brushless motors.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 2 **Cluster Standards** MN 6 **Pathway Standards** MN-MIR 1,2,3,4,5,6	**ELA** 9-10 R 1,2,4 9-10 W 2 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6 **Literacy** 9-10 RST 1,2,4,7 9-10 WHST 2 **Math** **Science** **Computer Science and Digital Fluency**

Third Quarter Project #3 Potential Driving Question How do parts contribute to form a system?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● How do sensors, actuators, controllers, and mechanical components work together? ● What is the function of contact or relay? ● How is overload determined for a given application? ● What causes the rotor to turn in an electrical motor or generator? ● What is torque? ● What information does a motor curve provide? ● What symbols are used in a line diagram? ● Why are line or wire numbers needed in a line diagram? ● What information is provided by a line diagram for the motor-control station? ● What information is needed prior to working on motors and controls?	● Describe how a motor's operation can be enhanced such as the use of variable drive in AC motors and micro stepper in a stepper motor. ● Describe the operation of a servo motor. ● Compare and contrast unipolar, bipolar, and universal stepper motors. ● Describe the interaction of sensors. actuators, controllers, and mechanical components including starters, relay switches, timers, and variable frequency drives. ● Explain how and when a contact or relay is triggered. ● Explain how overload is determined for a given application. ● Explain the relationship between voltage, current, power and RPM (revolutions per minute). ● Define torque. ● Explain the information found in a motor curve. ● Identify and define common symbols in a line diagram. ● Explain why line or wire numbers are needed in a line diagram.			

Third Quarter Project #3 Potential Driving Question How do parts contribute to form a system?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		● Interpret line diagrams for motor controls stations to include symbols, line number, wire numbers, reference numbers. ● Demonstrate use of ohmmeter and ammeter. ● Demonstrate basic troubleshooting for motors, connections, and controls. ● Demonstrate checking starting relays, capacitors, and overloads in a safe manner.			
Circuits	● What are circuits? ● How does electricity move through a circuit? ● What role does a conductor and insulator have in electricity? ● What is the relationship between current and resistance? ● How is current and resistance measured? ● What is the relationship between conductors, insulators, resistors, capacitors, inductors? ● How does an open-circuit work? ● How does a closed-circuit work? ● How do an open and closed circuit differ? ● What are series circuits? ● What are parallel circuits? ● What is the relationship between Ohms and Watts Laws and volts, amperage, and ohms? ● What is Thevenin's Theorem? ● How is Thevenin's theorem applied?	● Explain what a circuit is and how it functions. ● Explain how electrons move from positive to negative. ● Explain the importance of conductors and resistors and give examples. ● Explain current voltage and resistance. ● Demonstrate measurement of current. ● Explain relationship among conductors, insulators, resistors, capacitors, and inductors. ● Explain operation of open and closed circuits. ● Compare and contrast open and closed circuits. ● Explain operation of series and parallel circuits. ● Compare and contrast series and parallel circuits	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 2 **Cluster Standards** MN 6 ST 1 **Pathway Standards** MN-PPD 1 ST-ET 6	**ELA** 9-10 R 1,2,4 9-10 W 2 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6 **Literacy** 9-10 RST 1,2,4,7 9-10 WHST 2 **Math** **Science** **Computer Science and Digital Fluency**

Third Quarter Project #3 Potential Driving Question How do parts contribute to form a system?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● What is Norton Theorem? ● How is Norton's' Theorem different from Thevenin's theorem? ● How is Norton's Theorem applied? ● What is the superposition theorem? ● How does the superposition theorem simplify an analysis? ● What is the maximum power transfer theorem? ● What is nodal analysis? ● What is mesh analysis? ● How can the current circulating through a loop or mess be determined? ● What is the relationship of Kirchoff and Ohms law to mesh analysis? ● How can circuit behavior be predicted and verified? ● How is series resistance calculated? ● How is parallel resistance calculated? ● What is the purpose of a flyback or snubber diode? ● How does a wheatstone bridge work? ● How does a potentiometer work? ● How do the electromagnetic components operate in a system? ● How is wiring for series and parallel circuits completed? ● What are common troubleshooting procedures?	● Explain what information Ohm's and Watts law provide. ● Demonstrate application of power formulas and calculations. ● Explain Thevenin's Theorem. ● Demonstrate calculations with Thevenin's Theorem. ● Explain Norton's Theorem. ● Compare and contrast Norton's and Thevenin's Theorems. ● Demonstrate calculations with Norton's Theorem. ● Explain superposition theorem. ● Describe how superposition theorem can simplify an analysis. ● Explain the maximum power transfer theorem. ● Explain nodal analysis. ● Explain mesh or loop analysis. ● Apply mesh or loop analysis to determine current flow. ● Explain the relationship of Kirchoff and Ohm's Law to mesh analysis. ● Analyze schematics and apply Ohm, Kirchhoff, and Watts Laws to troubleshoot simple circuits. ● Demonstrate calculation of series circuit resistance.			

Third Quarter Project #3 Potential Driving Question How do parts contribute to form a system?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● Why is documentation important during troubleshooting? ● How is documentation formatted? ● Why does working as a team help the troubleshooting process?	● Demonstrate calculation of parallel circuit resistance. ● Explain the purpose of a flyback or snubber diode. ● Explain how a wheatstone bridge works. ● Demonstrate use of a potentiometer. ● Explain how coils, solenoids, relay sensor and contractors operate as a system. ● Demonstrate building of both a series and parallel circuit following schematics and wiring diagrams. ● Demonstrate application of measurement tools, analysis of data, and synthesis of calculations to troubleshoot circuit function. ● Explain the importance of documentation during troubleshooting. ● Demonstrate technical writing in reports and documentation. ● Demonstrate clear concise documentation of trouble shooting experiences. ● Demonstrate ability to work as part of a technical team.			

Fourth Quarter Project #4 Potential Driving Question: How do scientific discoveries and advances impact manufacturing?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Logic Gates	● What are logic gates? ● What type of logic do two (normally closed and normally open) switches in parallel represent? ● What type of logic do two (normally closed and normally open) switches in series represent? ● Why are logic gates fundamental building blocks?	● Describe varied types of logic gates. ● Describe the function of logic gates. ● Demonstrate use of logic gates to build or run circuits.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments Teacher Observation/ Checklist	**Career Ready Practices** CRP 2	**ELA** 9-10 R 1,2,4 9-10 W 2 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6
				Cluster Standards ST 2	**Literacy**
				Pathway Standards ST-ET 1	**Math**
					Science
					Computer Science and Digital Fluency
Vacuum: What, Why and How	● What is a vacuum? ● What are examples of application of vacuum in fabrication or manufacturing? ● What is atmospheric pressure? ● How is atmospheric pressure measured (what gas is used) and expressed? ● What is the significance of a negative atmospheric pressure? ● What instruments measure pressure? ● What are key terminology? ● How is a vacuum created? ● What type of pumps and gauges are used? ● Why is the vacuum environment used? ● What happens if there is a leak in a vacuum environment? ● How is the vacuum environment sealed?	● Define what vacuum is. ● Identify current and future applications for vacuum in varied industries and technologies. ● Define atmospheric pressure. ● Apply appropriate terminology for measurement of gas pressure. ● Describe the relationship of negative atmospheric pressure and a vacuum environment. ● Demonstrate using varied tools and gauges to read pressure. ● Define common terms used in vacuum technology such as; thermal gauges, direct and indirect pressure	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 2	**ELA** 9-10 R 1,2,4 9-10 W 2 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6
				Cluster Standards MN 6 ST 1	**Literacy** 9-10 RST 1,2,4,7 9-10 WHST 2
				Pathway Standards MN-MIR 1,3,4,5,6 MN-PPD 4 MN-PRO 1,2,3,4,5 ST-ET 2	**Math**
					Science
					Computer Science and Digital Fluency

Fourth Quarter Project #4 Potential Driving Question: How do scientific discoveries and advances impact manufacturing?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment** **Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● How is a vacuum environment maintained? ● Where might leaks occur? ● What is leak testing? ● What are procedures and protocols used in leak testing? ● What is a Mass Spectrometer Leak Detector (MSLD)?	measurement, bleed, upstream and downstream, throttle, vacuum control, active gauge, vacuum controller, micron, deep vacuum method of evacuation. ● Describe the process of creating a vacuum. ● Identify components such as pumps, seals, and gauges used to maintain a vacuum environment. ● Identify materials used to create vacuum environments. ● Demonstrate the process of creating a small vacuum. ● Explain why and when a vacuum environment is used during semiconductor Microchip Technology. ● Demonstrate results if an O ring seal is faulty. ● Identify common sources of leaks such as holes, cracks, or flaws. ● Describe the procedure of leak testing to determine whether a system is functioning at desired levels. ● Identify testing methods to check for leaks such as the helium leak test. ● Demonstrate use of MSLD.			

Fourth Quarter Project #4 Potential Driving Question: How do scientific discoveries and advances impact manufacturing?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment** **Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		● Demonstrate analysis of the vacuum system to determine if it is functioning correctly. ● Demonstrate locating and repairing leaks in a system.			
Career Exploration	● What are different engineering pathways within this field? ● What are the job responsibilities and educational requirements for an engineering pathway? ● What are some technician careers/roles within this field? ● What are job responsibilities and educational requirements for technicians? ● What are different careers associated with trades to support facilities and the fabrication process? ● What are job responsibilities and education requirements for supporting trades? ● What pathway is of most interest? ● What are specific industry certifications that will support career goal? ● What additional information and experiences are needed to inform career decisions?	● Identify engineering specialties associated with this field such as material, mechanical, electrical, and computer. ● Identify educational requirements and typical job tasks for engineers. ● Identify varied types of technicians associated with this field. ● Identify educational requirements and typical job tasks for technicians. ● Identify support trades such as electrician, operations and maintenance, automation, cleanroom systems, and HVAC found in this industry. ● Identify educational requirements and typical job tasks for support trades. ● Identify industry certifications that support career pathway goal. ● Identify areas of interest. ● Generate questions to gather additional information.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 3,7,10	**ELA** 9-10 R 1 9-10 W 2,3,5 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6
				Cluster Standards MN 4 ST 5	**Literacy** 9-10 WHST 4,5,6,7
				Pathway Standards	**Math**
					Science
					Computer Science and Digital Fluency

Fourth Quarter Project #4 Potential Driving Question: How do scientific discoveries and advances impact manufacturing?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		● Summarize research, including interviews, and observations regarding career pathways of interest.			
Reflection	● How might personal goals need to be revised? ● How is learning and skill acquisition documented?	● Articulate goals, accomplishments, and revisions. ● Communicate skills and knowledge through employability profile, resume and portfolio. ● Document credentials earned.	**Written** ● Self-Assessment ● Written Reflection ● Professional Portfolio **Performance** ● Class Presentation ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 10	**ELA** 9-10 W 3 9-10 SL 1,2,3,4,5,6 9-10 L 1,2,4,6
				Cluster Standards MN 4 ST 5	**Literacy** 9-10 WHST 4
				Pathway Standards	**Math**
					Science
					Computer Science and Digital Fluency

Corcoran High School
Computer Chip Design and Production Pathway
Course Syllabus
Level 3

Pathway Overview

This 4-year sequence of Computer Chip Design and Production courses will prepare students to enter the field of high technology fabrication. Students will be poised to enter the industry directly as a technician, or continue their education to obtain an associate's degree in electromechanical, mechatronics or semiconductor microchip technology. Within this pathway students will explore career possibilities through research, field visits and professional mentoring. Students will obtain safety certification to work in an industrial setting, be able to apply background information in physics, chemistry, and math to understand the fabrication process and to trouble-shoot processes and machines. Students will have a solid background in applied electrical theory and clean laboratory protocols. Students will demonstrate their skills as technical readers and writers and demonstrate professional communication skills. Students will balance individual skills with group development skills including collaboration, communication, critical thinking, creativity, problem solving, perseverance, information literacy, technology skills, and digital literacy. They will develop awareness of motivating and supporting others including an awareness of diversity, ethical and professional practices. Students will have opportunities to pursue certifications including, but not limited to: OSHA 10, Microsoft Word and Excel, receive 18-24 college credits and other industry certifications demonstrating their knowledge and career readiness for this field.

Course Description

During the third year, students refine their technical reading, writing and presentation skills. They expand their digital literacy by examining programming concepts, tools and constructs including programmable logic controllers. They work to solve complex problems by deconstructing a problem, analyzing causes and other factors, to propose and evaluate possible solutions. This further develops students' ability to troubleshoot processes and mechanicals. Technical skills continue to be developed through the deeper exploration of fluid power and mechanics. Consideration is also given to students' study of ethics and awareness of diversity and other issues and concerns. Through mentorship, students will be encouraged to develop their identity as a professional in a STEAM career.

All students will engage in project-based learning at a minimum of a project each quarter. Intrinsic to project-based learning is to examine a driving question or identify a problem by articulating what is already known, and what students need to know to answer the question. Students are guided to develop and execute a plan culminating in a presentation or product demonstrating their response to the initial question or problem. This process concludes with self-reflection regarding their learning. As such, learning happens during project execution and not solely as a final activity to show learning.

Work-Based Learning

Students will be connected with local and national employers and industries throughout their learning experiences especially as they complete project-based learning experiences. These professional connections may include interviews, field trips to local businesses, job shadowing and career coaching. It is expected that these experiences will lead to opportunities for direct job training and real-world experience. Students will create and maintain a portfolio of their experiences to document the development of their skills, including a professional resume.

Additional Learning Opportunities

- **Micro-credentials:** Students may pursue learning experiences and credentials depending on the requirements of the project that they are involved in. Some examples for this pathway include, but are not limited to:
    - Microsoft Office Specialist: Word Associate
    - Microsoft Office Specialist: Excel Associate
    - OSHA 10 Hour
    - Other Industry certifications such as such as CISCO, CompTIA and others

- **Summer Bridge Enrichment:** Students will have the opportunity to participate in cross-curricular Summer Bridge programs to enhance and enrich their skills. Students will explore and create solutions that address authentic needs in the school and wider community with the involvement of local industry professionals. Students will build on skills learned during the school year to work collaboratively with students from other pathways and programs.

Pre-Requisites

Computer Chip Design and Production Levels 1 and 2

Course Objectives

At the completion of this course students will know and be able to:

- Accurately read and interpret technical drawings and documentation.
- Communicate through concise and clear documentation.
- Demonstrate understanding of programming concepts and constructs.
- Develop and document programs.
- Demonstrate the use of appropriate data types, syntax, logic and program controls to create programming solutions.
- Examine and diagram the basic design of databases, graphical user interfaces and communication protocols in programming.
- Identify complex problems and apply a process to evaluate a solution.
- Explain the relationship between problem solving and troubleshooting.
- Identify fluid power systems and devices and explain functions of components and systems.
- Interpret fluid power drawing and diagnose fluid power systems as part of basic troubleshooting (including any calculations of flow rate, flow velocity and mechanical advantage in a hydraulic system).
- Identify common components and functions of different mechanisms.
- Interpret mechanical drawings and demonstrate assembly of mechanisms correctly.
- Calculate performance of common industrial mechanisms and troubleshoot common problems.
- Demonstrate communication and presentation skills utilizing data and visuals.
- Explain and discuss current ethical and environmental concerns within this field.
- Demonstrate troubleshooting with programmable logic controllers.

Integrated High School Academics

N/A

Concurrent College Enrollment

TBD- Possible OCC ELM 100, ELM 105, ELM 107, ELM 109 (8 credits)

Equipment and Supplies

- **School will provide:** All tools including technology, equipment and supplies to complete projects
- **Student will provide:** N/A

Textbook

TBD

Grading

40% Classwork assignments including any quizzes/tests
60% Projects and presentations (rubric)

Additional Course Policies

Students are expected to:

- Meet all deadlines and be on time.
- Deadlines and being on time are a major part of being a professional.
- Produce their best work, including being prepared for presentations.
- Participate in class including contributing to discussions and critiquing their own and others' work, as well as diligently working on their own projects.
- Seek help when needed.
- Be attentive, ask questions if they do not understand something, and offer their opinions.
- Use Microsoft 365 and other technology tools for preparing and sharing all work.
- Give credit and use proper citations for all research and project ideas.

Course Calendar

Quarter	Driving Question/ Project	Units of Study
1	**What impact may result from unclear or omitted documentation?**	● Class Expectations and Policies ● Safety Review ● Technical Reading and Writing ● Programming Fundamentals (part 1)
2	**How do processes and procedures lead to better solutions?**	● Programming Fundamentals (part 2) ● Introduction to Problem Solving ● Career Exploration
3	**How can we plan, prevent and respond to problems?**	● Fluid Power ● Mechanisms (Part 1)
4	**In what ways do current local, national, and global issues impact business and manufacturing decisions and practices?**	● Mechanisms (Part 2) ● Presentations with Data and Visuals ● Ethics and Emerging Technologies ● Programmable Logic Controls ● Career Exploration and Reflection

Corcoran High School
Computer Chip Design and Production Pathway
Scope and Sequence
Level 3

First Quarter Project #1 Potential Driving Question: What impact may result from unclear or omitted documentation?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Class Expectations and Policies **Safety Review**	● What are the expectations for students in the Computer Chip Design and Production program? ● What are key safety concepts? ● How is safety maintained in a job-site or lab?	● Develop classroom rules and establish relationships. ● Articulate goals towards a career of choice. ● Demonstrate in daily practice safety protocols such as identifying and mitigating potential hazards and unsafe practices.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1	**ELA** 11-12 W 3 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,4,6
				Cluster Standards MN 5 ST 3	**Literacy** 11-12 WHST 3
				Pathway Standards MN-MIR 2 MN-PPD 3 MN-PRO 2,5 MN-QA 5	**Math** **Science** **Computer Science and Digital Fluency**
Technical Reading and Writing	● Why is clear and concise communication important? ● What makes technical reading and writing different from literary reading and writing? ● How does text structure assist the reader? ● How is professionalism demonstrated in emails and other forms of communication? ● What information do technical documents provide? ● What might be impact if a technical document is	● Explain the importance of clear and concise communication. ● Compare and contrast technical reading and writing with literary reading and writing. ● Explain various text structures and how those structures support technical reading and writing. ● Demonstrate professional language and conduct in email and other communication forms.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 2,4	**ELA** 11-12 R 1,2,3,4,5,6, 11-12 W 1,2 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6
				Cluster Standards MN 6 ST 1,2	**Literacy** 11-12 RST 1,2,3,4,5,6,8 11-12 WHST 1,2,3,4
				Pathway Standards MN-MIR 1,3,5,6 MN-PPD 1,2,3,4,5	**Math** **Science**

First Quarter Project #1 Potential Driving Question: What impact may result from unclear or omitted documentation?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	misinterpreted or contains an error? ● How are adjustments and actions recorded? ● What problems may occur if actions are not documented or colleagues do not have access to the latest version? ● How does documentation improve future prediction and/or avoidance of future problems? ● How does documentation facilitate communication across shifts and among personnel?	● Interpret technical documents such as data sheets, operating manuals, reports, schematics, and diagrams. ● Evaluate a technical document or data sheet for accuracy, clarity, and ease of comprehension. ● Revise a technical document or data sheet to correct an error or to add clarity. ● Create a technical data sheet. ● Create a technical document detailing an operational procedure. ● Explain the purpose of logs, access, and version management. ● Demonstrate updating a log that includes action, date, and justification. ● Explain how well-maintained records and documentation help predict future issues and assist in troubleshooting. ● Explain how documentation provides continuity across personnel whether due to different shifts, work days, or personnel turnover.		MN-QA 1.3.4.6.7	**Computer Science and Digital Fluency**
Programming Fundamentals (Part 1)	● What is mechatronics? ● How do humans develop and communicate with machines?	● Explain mechatronics and how semiconductor industry is a subgroup of this field.	**Written** ● Self-Assessment ● Class Assignments	**Career Ready Practices** CRP 1,2,4,5,8,11,12	**ELA** 11-12 R 1,2,4,7 11-12 W 2

First Quarter Project #1 Potential Driving Question: What impact may result from unclear or omitted documentation?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● What is the Internet of Things and Industrial Internet of Things? ● What are common programming languages used in this field? ● What are the applications of commonly used scripting languages? ● How is logic and coding implemented? ● What is the relationship between computer hardware, computer software, and computer system components? ● What is algorithmic procedure? ● What are the basic concepts of a programming language? ● What are common data types? ● How are decision points programmed? ● What is the software development life cycle (SDLC)? ● How is a program developed? ● How are English instructions translated into programming language? ● How does an automated system function? ● What is the difference between a closed and open loop system?	● Explain structures in place to communicate and control machines. ● Describe the use of logic in programming machines used in industry. ● Describe block type and text-based programming languages. ● Define the terms Internet of Things (IoT) and Industrial Internet of Things (IIoT). ● Describe the fundamental principles and components of the Internet of Things and application to Computer Chip Design and Production. ● Identify names of common procedural programming languages and scripting languages such as Python or Lynx. ● Demonstrate use of scripting language to interact with a device such as Raspberry Pi. ● Describe the functions of computer hardware, computer software, and computer system components. ● Explain algorithmic procedure as problem statement, creation of possible solutions, determination of best solution.	● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation or Checklist	**Cluster Standards** ST 1,2 **Pathway Standards** ST-ET 1,2,3,4,5,6 ST-SM 2,4	11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6 **Literacy** 11-12 RST 1,2,4,5 11-12 WHST 2 **Math** **Science** **Computer Science and Digital Fluency**

First Quarter Project #1 Potential Driving Question: What impact may result from unclear or omitted documentation?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		● Describe basic concepts of a programming language such as variables, control structures, data types, data structures, syntax, and tools. ● Identify common data types such as: integers, real numbers, characters, Boolean, lists, strings. ● identify common decision points such as: conditional branching, logical operators, looping. ● Demonstrate use of decision points by creating flowcharts and pseudocode. ● Identify the following as basic steps in the software development life cycle: define the problem, develop the algorithm, code the program, test the program, debug the program, document the program, implement the program, and maintain the program. ● Translate logical expressions into schematic or symbolic representation. ● Design a program, using an algorithm, pseudocode, a flowchart, and/or a decision table. ● Translate the algorithm, pseudocode, flowchart, or decision table into a			

First Quarter Project #1 Potential Driving Question: What impact may result from unclear or omitted documentation?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment** **Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		standard procedural programming language. ● Demonstrate testing the program with sample data. ● Demonstrate debugging the program including identifying and fixing syntax, logic, and runtime errors. ● Demonstrate documenting the program including in-line comments, user notes to provide both internal and external documentation for a program. ● Demonstrate implementation of the program which may include compiling code, creating an executable file, or running a script. ● Explain how an automated systems function. ● Explain the difference between open and closed loop system design and implementation. ● Interpret the flow of information in a control function for an automated system. ● Define the software design process including input, processing, and output, user interface design (UI) and user experience (UX).			

Second Quarter Project #2 Potential Driving Question: How do processes and procedures lead to better solutions?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Programming Fundamentals (Part 2) **(OCC ELM 109)**	● How do databases provide information? ● What is Structured Query Language (SQL) ● What are the steps in database development life cycle? ● What are the steps in database design? ● How is a database created? ● How is a database interpreted? ● How is a database managed? ● What are graphical user interfaces (GUI)? ● What are design considerations for GUI? ● What are communication protocols in programming? ● What are different computer languages commonly used and for what purposes? ● How is a proficiency in a computer language demonstrated?	● Identify the characteristics of different types of databases. ● Compare and contrast applications of different types of databases (relational vs non-relational types). ● Define SQL. ● Describe the database development life cycle. ● Apply design concepts to database models. ● Create a relational database by conceptual design, write code, test code, implement and document. ● Demonstrate proficiency in following the logic of database designs. ● Interpret data from databases. ● Evaluate database for stability and accuracy. ● Describe the steps and outcomes considered when developing a database. ● Define and give examples of graphics user interface (GUI). ● Explain the importance of font style, font size, color scheme, and end-user needs, including the needs of users with disabilities when designing a GUI.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1,2,4,5,8,11,12 **Cluster Standards** ST 1,2 **Pathway Standards** ST-ET 1,2,3,4,5,6 ST-SM 2,4	**ELA** 11-12 R 1,2,4,7 11-12 W 2 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6 **Literacy** 11-12 RST 1,2,4,5 11-12 WHST 2 **Math** **Science** **Computer Science and Digital Fluency**

Second Quarter Project #2 Potential Driving Question: How do processes and procedures lead to better solutions?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment** **Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		● Evaluate examples of GUI for attention to user need. ● Create a graphical user interface. ● Demonstrate adherence to all documentation for programs, and revisions. ● Identify various computer languages and applications. ● Demonstrate writing and executing a program.			
Introduction to Problem Solving **(OCC ELM 100)**	● What are types of problems? ● What is the difference between open and closed ended problems? ● What are some problem-solving approaches? ● What is the importance of critical thinking to solving problems? ● What is root cause analysis? ● How does a root cause analysis help solve a problem? ● How do cause and effect diagrams help solve a problem? ● What is fault tree analysis? ● How does fault tree analysis help solve a problem? ● What are some brainstorming strategies? ● How are problem solving strategies applied to solve technical problems? ● How are solutions evaluated? ● How are problem solving and troubleshooting similar? ● What traits support lifelong learning?	● Identify and describe types of problems. ● Compare and contrast open and closed ended problems. ● Describe several problem-solving approaches. ● Explain why critical thinking is important for solving problems. ● Define root cause analysis. ● Describe how root analysis helps to surface a problem. ● Describe how cause and effect diagrams help to identify a problem. ● Define fault tree analysis. ● Explain how fault tree analysis helps to identify a problem. ● Describe brainstorm strategies. ● Apply brainstorming, root cause analysis, cause and effect, and fault tree analysis to solve technical problems.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1,4,5,6,7,8,9,11,12	**ELA** 11-12 R 1,2,4,7 11-12 W 2 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6
				Cluster Standards ST 1,2,	**Literacy** 11-12 RST 2,3,4,6,7,8,9 11-12 WHST 2
				Pathway Standards ST-ET 1,2,3,4,5, ST-SM 4	**Math**
					Science
					Computer Science and Digital Fluency

Second Quarter Project #2 Potential Driving Question: How do processes and procedures lead to better solutions?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment** **Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		● Demonstrate evaluation of potential solutions with application of criteria, consequences, implications, and results. ● Describe characteristics of problem solving and troubleshooting. ● Explain the importance of lifelong learning and what traits support lifelong learning.			
Career Exploration	● What can be learned from professionals in the field? ● What is noted about how employees function on the job (time management, communication, respect, use of personal devices, etc.)? ● How do experiences with job shadowing and mentoring/coaching impact career goals?	● Demonstrate professional behaviors and traits in job shadow and coaching/mentoring experiences. ● Identify how employees demonstrate professional behaviors. ● Expand and refine career goals based on career coaching and job shadowing experiences.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 10	**ELA** 11-12 R 1,2 11-12 W 2,3 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6
				Cluster Standards MN 4 ST 5	**Literacy** 11-12 WHST 3
				Pathway Standards	**Math**
					Science
					Computer Science and Digital Fluency

Third Quarter Project #3 Potential Driving Question: How can we plan, prevent,and respond to problems?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Fluid Power **(OCC ELM 107)**	● What is fluid power? ● What types of systems and devices use fluid power? ● How does a fluid power system differ from a mechanical power system? ● Why and when is a fluid power system preferred? ● What are safety procedures to implement when working with fluid power systems? ● What are the principles of fluid power? ● How do thermodynamics factor into fluid power systems? ● How do pressure and temperature affect fluid power systems? ● How does a fluid power system work? ● What fluids are used in hydraulic and pneumatic systems? ● Why are gasses compressible? ● What are Pascal's and Boyle's Laws? ● What are components of a fluid power system? ● What are different types of solenoids? ● What are the functions of various valves? ● What is the function of the pressure regulator? ● What is an actuator? ● What factors influence selection of the type of actuator?	● Define fluid power. ● Identify examples of systems and devices utilizing fluid power. ● Describe how fluid power systems and controls function. ● Name two types of fluid power. ● Compare and contrast fluid power systems and mechanical power systems. ● Describe the advantages of fluid power systems. ● Demonstrate use of PPE when working with fluid power systems. ● Describe safety precautions when working with fluid power systems. ● Describe responses for a hydraulic injection accident. ● Describe the physics, use of liquid or gas and components of a fluid power system including force, speed, friction, flow, pressure, and power within a fluid power system. ● Describe how fluid power systems work to convert energy. ● Explain the relationship of pressure and temperature on fluid power systems.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 2 **Cluster Standards** MN 6 **Pathway Standards** MN-MIR 1,2,3,4,5,6	**ELA** 11-12 R 1,2,4 11-12 W 2 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6 **Literacy** 11-12 RST 1,2,4 11-12 WHST 2 **Math** **Science** **Computer Science and Digital Fluency**

Third Quarter Project #3 Potential Driving Question: How can we plan, prevent,and respond to problems?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● What are different types of pumps or compressors used in fluid power? ● What are the advantages and disadvantages of types of pumps and compressors? ● What is cavitation? ● What symbols are used for fluid power components? ● How are fluid power circuit diagrams read? ● How is a fluid power system constructed? ● What adjustments might need to be made to a fluid power system? ● What documentation is needed? ● Why might a fluid power system breakdown? ● What are routine maintenance functions? ● What considerations need to be taken when troubleshooting a fluid power system? ● How is flow rate, flow velocity and mechanical advantage determined? ● What are some differences and similarities between hydraulic and pneumatic systems? ● What are some advantages and disadvantages of hydraulic and pneumatic systems? ● When would a hydraulic system be better to use than a pneumatic system and vice versa?	● Identify liquids and gasses utilized in fluid power systems. ● Explain the compressibility of gasses. ● Explain Pascal and Boyle Laws and the application to fluid power systems. ● Identify and state function of components of a fluid power system such as: reservoirs, accumulators or bladders, valves, gauges, cylinders, limit switches, solenoids, supply elements (pumps/compressors), and actuators. ● Identify types of solenoids. ● Describe varied functions of various valves. ● Describe the function of a pressure regulator. ● Define what an actuator is and give examples. ● Describe factors influencing selection of an actuator. ● Identify positive displacement and non-displacements pumps and describe how they work. ● Compare and construct types of pumps and compressors. ● Identity when turbine or centrifugal pumps might be used. ● Explain cavitation.			

Third Quarter Project #3 Potential Driving Question: How can we plan, prevent,and respond to problems?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment** **Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		● Identify symbols used in fluid power diagrams. ● Demonstrate accurate reading of a fluid power diagram by summarizing. ● Demonstrate reading of symbols and diagrams to construct a fluid power system including connecting a supply element to a control device and an actuator. ● Describe and document the construction of the system and how it works. ● Demonstrate making common adjustments such as flow control, pressure regulation, current to pressure transducer and voltage to pressure transducer. ● Demonstrate documenting any adjustments. ● Describe common breakdown points in a fluid power system. ● Describe routine maintenance functions to be performed on a fluid power system. ● Demonstrate application of troubleshooting process with a fluid power system. ● Demonstrate calculation of flow rate, flow velocity and mechanical advantage in a hydraulic steam.			

Third Quarter Project #3 Potential Driving Question: How can we plan, prevent,and respond to problems?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment** **Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		● Compare and contrast hydraulic and pneumatic systems including what components are common to both hydraulic and pneumatic systems. ● Name advantages and disadvantages of hydraulic and pneumatic systems. ● Evaluate which fluid power system would be most effective in a given environment and application.			
Mechanisms (Part 1)	● What are mechanisms? ● What are specific safety protocols when working with mechanisms? ● What are the types of actuators? ● What are common sensors? ● What do sensors do? ● What is the difference between analog and digital sensors? ● What are different gears? ● Where are the following found: levers, gear drives, belt drives, chain drives, lead screws/ball screws? ● What are mechanical elements?	● Give examples of mechanisms and where they are encountered. ● Describe PPE and safety protocols when working with mechanisms. ● Demonstrate in daily practice safety protocols such as identifying and mitigating potential hazards and unsafe practices. ● Identify actuators as electromechanical, hydraulic, or pneumatic. ● Identify common sensors. ● Explain how sensors work. ● Match sensors to what is being measured such as: switches, temperature, force, speed, pressure, flow rate, proximity, magnetism, light.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 2 **Cluster Standards** MN 6 **Pathway Standards** MN-MIR 1,2,3,4,5,6	**ELA** 11-12 R 1,2,4 11-12 W 2 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6 **Literacy** 11-12 RST 1,2,4 11-12 WHST 2 **Math** **Science** **Computer Science and Digital Fluency**

Third Quarter Project #3 Potential Driving Question: How can we plan, prevent,and respond to problems?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment** **Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		● Explain the difference between analog and digital sensors. ● Identity types of gears. ● Give examples of levers, gears drives, belt drives, chain drives and lead screw/ball screws. ● Identify elements such as: fasteners, bearings, couplings, gears, shafts, springs, sheaves, sprockets, shims.			

Fourth Quarter Project # 4 Potential Driving Question: In what ways do current local, national, and global issues impact business and manufacturing decisions and practices?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Mechanisms (Part 2)	● What type of maintenance do machine elements require? ● What are parts of a motor control system? ● What are the main types of connectors used for electrical connections? ● How are line diagrams interpreted for motor control stations? ● What is the difference between NO and NC switches? ● How are motor control stations assembled? ● How are gear ratios determined? ● Why are accurate mechanical drawings important? ● What are common problems with mechanical systems?	● Explain the importance of inspections and regular maintenance such as lubrication. ● Describe the parts of the motor control system including motor starters, overload, contactor/relay, switches, timers, variable frequency drives. ● Describe types of connectors such as plug-and- socket connectors, jacks and plugs, crimp-on connectors, soldered connectors, insulation-displacement connectors, binding posts, screw terminals, ring-and-spade connectors, blade connectors. ● Demonstration accurate reading of line diagrams for motor control stations including symbols, line numbers, wire numbers, and reference numbers. ● Explain the difference between normally open and normally closed switches. ● Demonstrate assembly of a motor control NO and NC switches for varied purposes such as: single start/stop, multiple start/stop, start/stop/jog, sequential start/stop, safety start, forward/reverse.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 2 **Cluster Standards** MN 6 **Pathway Standards** MN-MIR 1,2,3,4,5,6	**ELA** 11-12 R 1,2,4 11-12 W 2 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6 **Literacy** 11-12 RST 1,2,4 11-12 WHST 2 **Math** **Science** **Computer Science and Digital Fluency**

Fourth Quarter Project # 4 Potential Driving Question: In what ways do current local, national, and global issues impact business and manufacturing decisions and practices?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		● Demonstrate accurate determination of gear ratios. ● Explain the importance of accurate mechanical drawing and potential problems if schematics or drawing are not followed. ● Interpret a mechanical drawing to assemble the mechanism correctly. ● Apply troubleshooting protocols to determine and address common problems experienced with mechanical systems.			
Presentation with Data and Visuals	● How is data presented in a clear and concise manner? ● What are techniques and tools to display data effectively? ● What is public speaking? ● What are key techniques to support clear spoken communication to a group?	● Present written and oral communication in a clear, concise, and effective manner. ● Demonstrate use of techniques and technology tools to create visual displays of data. ● Identify key aspects to be an effective public speaker. ● Demonstrate clear spoken communication to a group. ● Demonstrate effective use of visuals and data displays to support oral and written presentations.	**Written** ● Self-Assessment ● Class Assignments ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 4 **Cluster Standards** ST 2 **Pathway Standards** ST-ET 2,5	**ELA** 11-12 W 2 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6 **Literacy** 11-12 RST 7 11-12 WHST 2 **Math** **Science** **Computer Science and Digital Fluency**
Ethics and Emerging Technologies	● What are some current events or ethical issues related to Computer Chip Design and Production and integrated chip technology? ● What are examples of emerging technology and fields of study	● Identify current events and ethical issues related to semiconductor technology and manufacturing. ● Identify emerging technological research such	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance**	**Career Ready Practices** CRP 1,4,5,8,9,12	**ELA** 11-12 R 1,2,4,7,9 11-12 W 1,2,3,5,6,7 11-12 SL 1,2,3,4,5,6

Fourth Quarter Project # 4 Potential Driving Question: In what ways do current local, national, and global issues impact business and manufacturing decisions and practices?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	related to Computer Chip Design and Production? ● What may be some implications of future technological developments? ● How are competing priorities and values balanced or determined? ● How do laws and ethics shape policy and practices in fabrication? ● What is the importance of laws that protect intellectual property rights? ● What is meant by the global economy? ● What is the impact of the global economy? ● What is the relationship between national security and Computer Chip Design and Production? ● What is required for security clearance? ● How is identity in a field developed?	as nanotechnology and quantum computing among others. ● Explain the potential impact of technological research and development currently under study may have on Computer Chip Design and Production. ● Describe ways that competing interests or priorities are balanced or not. ● Describe how laws and regulations impact practices. ● Describe how public advocacy can impact law and regulations. ● Explain how intellectual property rights are protected. ● Define the global economy. ● Describe the impact of the global economy on Computer Chip Design and Production. ● Describe the relationship between national security interests and Computer Chip Design and Production. ● Describe what might be required for a security clearance. ● Explain the impact of institutional racism and discrimination and identify	● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist		11-12 L 1,2,3,4,6
				Cluster Standards MN 1 ST 4	**Literacy** 11-12 RST 1,2,3,5,6,7,8,9 11-12 WHST 2.3.4.5.6.7
				Pathway Standards	**Math**
					Science
					Computer Science and Digital Fluency

Fourth Quarter Project # 4 Potential Driving Question: In what ways do current local, national, and global issues impact business and manufacturing decisions and practices?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		steps to network and locate mentors to develop an identity in the STEAM field. ● Analyze a current event or ethical issue related to semiconductor fabrication and determine what might be competing interests, benefits, and drawbacks to different groups, and how laws and regulations impact practice.			
Programmable Logic Controls	● What is the role of programmable logic controllers in automated systems? ● How does the Raspberry Pi function? ● What are different types of control systems? ● How are automated and non-automated systems alike and different? ● What are examples of a programmable controller? ● What components make up a programmable controller? ● What is the difference between a programmable logic controller (PLC) and a programmable automation controller (PAC)? ● What are the basic function and design of PLC's? ● What are logic gates? ● How do computers use logic to make decisions? ● What are the benefits of using a PLC over standard relay control and/or solid-state controls?	● Explain the role of programmable logic controllers (PLC) in automated systems. ● Identify devices used as control systems. ● Demonstrate application of programming and installation skills to incorporate use of a control system such as Raspberry PI. ● Compare and contrast automated and non-automated control systems. ● Identify examples of programmable controllers. ● Describe components such as central processing unit, integrated development environments, input/output modules, power supply. ● Compare and contrast PLC and PAC.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 2,11 **Cluster Standards** MN 6 ST 2 **Pathway Standards** MN-PPD 2 ST-ET 2	**ELA** 11-12 R 1,2,4 11-12 W 2 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6 **Literacy** 11-12 RST 1,2,4 11-12 WHST 2 **Math** **Science** **Computer Science and Digital Fluency**

Fourth Quarter Project # 4 Potential Driving Question: In what ways do current local, national, and global issues impact business and manufacturing decisions and practices?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● How is a PLC designed and function? ● What is ladder logic? ● What is function block diagram programming (FBD)? ● How are ladder diagrams interpreted? ● What are block diagrams? ● How are block diagrams interpreted? ● Where are ladder logic diagrams used most often? ● How does the ladder diagram simplify the logic tasks of a PLC program? ● How is a PLC connected to electrical components? ● Why might an emergency stop button be needed.? ● How does a PLC understand the sequencing of a program? ● How is a written program transferred to a functioning PLC? ● What are some additional safety considerations with automated PLC?	● Describe the basic functions and design of PLCs. ● Describe types of logic gates. ● Explain how logic is the basis of coding and programming computers. ● Describe how standard relay control, solid-state control and programmable controller work and what the benefits of PLC are. ● Identity components of a PLC and demonstrate functions of the components. ● Identify ladder diagrams and the information provided. ● Identify block diagrams and the information provided. ● Explain ladder logic diagrams and associated symbols. ● Explain function block diagram programming and associated symbols. ● Interpret ladder and block diagrams. ● Create a ladder diagram including legend. ● Create a block diagram including the legend. ● Convert wiring and line or ladder diagrams for simple logic tasks into PLC			

Fourth Quarter Project # 4 Potential Driving Question: In what ways do current local, national, and global issues impact business and manufacturing decisions and practices?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		programs using common instructions. ● Demonstrate connection of a PLC with components such as a NO and NC start and stop, seniors, relays, and drives. ● Explain the importance of an emergency stop and how that works. ● Create PLC program with: single start/stop with counter, sequential start/stop with timer, forward/reverse motor controllers. ● Demonstrate downloading of a written program to a PLC and performing functions according to criteria provided. ● Demonstrate use of safety switches, protocols and procedures when working with automated programmable logic controls.			
Career Exploration and Reflection	● What industry recognized certifications have been obtained and how will additional certifications be pursued? ● How are skills and experiences documented?	● Summarize industry certifications obtained and create plan for any additional industry certifications. ● Update and revise resume, portfolio, and employability profile.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 10 **Cluster Standards** MN 4 ST 5 **Pathway Standards**	**ELA** W3 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6 **Literacy** 11-12 WHST 3 **Math** **Science**

Fourth Quarter Project # 4 Potential Driving Question: In what ways do current local, national, and global issues impact business and manufacturing decisions and practices?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment** **Evidence of Learning**	**CCTC Standards**	**NYS Standards**
					Computer Science and Digital Fluency

Corcoran High School
Computer Chip Design and Production Pathway
Course Syllabus
Level 4

Pathway Overview

This 4-year sequence of Computer Chip Design and Production courses will prepare students to enter the field of high technology fabrication. Students will be poised to enter the industry directly as a technician, or continue their education to obtain an associate's degree in electromechanical, mechatronics or Computer Chip Design and Production technology. Within this pathway students will explore career possibilities through research, field visits and professional mentoring. Students will obtain safety certification to work in an industrial setting, be able to apply background information in physics, chemistry and math to understand the fabrication process and to trouble-shoot processes and machines. Students will have a solid background in applied electrical theory and clean laboratory protocols. Students will demonstrate their skills as technical readers and writers and demonstrate professional communication skills. Students will balance individual skills with group development skills including collaboration, communication, critical thinking, creativity, problem solving, perseverance, information literacy, technology skills, and digital literacy. They will develop awareness of motivating and supporting others including an awareness of diversity, ethical and professional practices. Students will have opportunities to pursue certifications including, but not limited to: OSHA 10, Microsoft Word and Excel, receive 18-24 college credits and other industry certifications demonstrating their knowledge and career readiness for this field.

Course Description

For the culminating year, student focus is on application of technical skills and career ready practices. Students will demonstrate application for an internship and post-secondary or job position. New learning includes failure analysis and statistical process control. Students are expected to complete at minimum a 10-week internship and complete an individual or small group independent project. Understanding that all students may not be on an internship the same semester, the structure of the semesters allows for flexibility in timing for internship experience and class presentation of material.

All students will continue to engage in project-based learning. Intrinsic to project-based learning is to examine a driving question or identify a problem by articulating what is already known, and what students need to know to answer the question. Students are guided to develop and execute a plan culminating in a presentation or product demonstrating their response to the initial question or problem. This process concludes with self-reflection regarding their learning. As such, learning happens during project execution and not solely as a final activity to show learning. In the final year, students will have the opportunity to pursue a small group or independent project.

Work-Based Learning

Students will be connected with local and national employers and industries throughout their learning experiences especially as they complete project-based learning experiences. These professional connections may include interviews, field trips to local businesses, job shadowing and career coaching. It is expected that these experiences will lead to opportunities for direct job training and real-world experience. Students will create and maintain a portfolio of their experiences to document the development of their skills, including a professional resume.

Additional Learning Opportunities

- **Micro-credentials:** Students may pursue learning experiences and credentials depending on the requirements of the project that they are involved in. Some examples for this pathway include, but are not limited to:
    - Microsoft Office Specialist: Word Associate
    - Microsoft Office Specialist: Excel Associate
    - OSHA 10 Hour
    - Other Industry certifications such as such as CISCO, CompTIA and others
    -
- **Summer Bridge Enrichment:** Students will have the opportunity to participate in cross-curricular Summer Bridge programs to enhance and enrich their skills. Students will explore and create solutions that address authentic needs in the school and wider community with the involvement of local industry professionals. Students will build on skills learned during the school year to work collaboratively with students from other pathways and programs.

Pre-Requisites

Computer Chip Design and Production Levels 1,2 and 3

Course Objectives

Upon completion of this course students will know and be able to:

- Articulate career goals.
- Demonstrate application for post-secondary educational opportunities or work positions.
- Demonstrate positive physical and mental health and safety protections.
- Apply career ready skills and technical skills in an internship environment.
- Demonstrate application of failure analysis.
- Calculate and interpret measures of center, distribution, and linear regression.
- Explain statistical process control and demonstrate use of statistical tools.
- Demonstrate use of technology to make statistical calculations, create visual displays and models.
- Demonstrate collaborative problem-solving, effective communication, teamwork, persistence and good work habits.

Integrated High School Academics

CTE Integrated ELA Credit

Concurrent College Enrollment

TBD- Possible OCC MATH 108 (2 credits) and English 6 credits

Equipment and Supplies

- School will provide: ·All tools including technology, equipment and supplies to complete projects
- Student will provide: N/A

Textbook

TBD

Grading

40% Classwork assignments including any quizzes/tests
60% Projects and presentations (rubric)

Additional Course Policies

Students are expected to:

- Meet all deadlines and be on time.
- Deadlines and being on time are a major part of being a professional.
- Produce their best work, including being prepared for presentations.
- Participate in class including contributing to discussions and critiquing their own and others' work, as well as diligently working on their own projects.
- Seek help when needed.
- Be attentive, ask questions if they do not understand something, and offer their opinions.
- Use Microsoft 365 and other technology tools for preparing and sharing all work.
- Give credit and use proper citations for all research and project ideas.

Course Calendar

Quarter	Potential Driving Question/ Project	Units of Study
1	**What is your vision for the future?**	● Course Expectations and Policies ● Goal Setting and Career Exploration ● Career Preparedness and Application Processes ● Employee Safety and Protection ● Preparation for Internship
2	**How can data be used to predict outcomes of future events or to make decisions?**	● Troubleshooting: Failure Analysis ● Troubleshooting: Statistical Process Control
3	**What makes a successful internship experience?**	● Internship
4	**How does design influence function/ practice and vice versa- how does function/practice influence design?**	● Career Development and Employability ● Internship Synthesis and Evaluation ● Extended Project ● Reflection

Note: Internships may be completed in semester 2 or 3 and content may need to be repeated if some students intern in semester 2 and others in semester 3.

Corcoran High School
Computer Chip Design and Production Pathway
Scope and Sequence
Level 4

First Quarter Project #1 Potential Driving Question: What is your vision for the future?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Course Expectations **Goal Setting and Career Exploration**	● What are the expectations for students in the program? ● What certification and training requirements are necessary for specific career pathways of individual interest? ● What makes for a safe environment? ● What specific skills and attributes contribute to success in this field? ● How are career ready skills (communication, time management, use of social media, etc.) and practices demonstrated? ● Where are there job opportunities in this field? ● What are student goals for career and learning outcomes?	● Develop classroom rules and establish relationships. ● Identify certifications and training to support a career in this field. ● Demonstrate proficiency on any outstanding certifications (such as OSHA 10, Microsoft , CISCO, CompTIA, or others depending on teacher certification to offer) ● Demonstrate in daily practice safety protocols such as identifying and mitigating potential hazards and unsafe practices. ● Demonstrate knowledge and skills needed for success in this field. ● Demonstrate application of career ready skills and practices. ● Identify local, regional, and national employers. ● Define personal short and long-term goals.	**Written** ● Self-Assessment ● Class Assignments ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1,2,10 **Cluster Standards** MN 4 ST 5 **Pathway Standards**	**ELA** 11-12 R 7 11-12 W 2,3 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6 **Literacy** 11-12 WHST **3** **Math** **Science** **Computer Science and Digital Fluency**

First Quarter Project #1 Potential Driving Question: What is your vision for the future?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Career Preparedness and Application	● How do I build a successful life after high school? ● What do I want my future to look like? ● What college or career am I interested in? ● How do I apply for college or a specific job position? ● What documents are needed for application for college or job position? ● What is financial stability and why is it important to have a real-life budget?	● Articulate a vision for 2,5,10 years in the future. ● Explain the job application process. ● Find job boards and postings related to their area of interest. ● Complete job positions applications as applicable. ● Interpret NYS and IRS tax tables. ● Request letters of recommendation. ● Demonstrate interviewing skills. ● Identify and research any post-secondary education or training of interest. ● Understand financial obligations and opportunities for post-secondary education and training, including the FAFSA application process as applicable. ● Write a college essay for submission as applicable. ● Demonstrate financial knowledge about post-secondary budgets, including rent, auto costs, food, etc. ● Create a realistic budget that can be used post-high school.	**Written** ● Self-Assessment ● Class Assignments ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1,3,4,9,10 **Cluster Standards** MN 4 ST 5 **Pathway Standards**	**ELA** 11-12 R 1,2,4,7 11-12 W 2,3 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6 **Literacy** 11-12 RST 2,6,7,8 11-12 WHST 2,3,4,5,6,7 **Math** **Science** **Computer Science and Digital Fluency**

First Quarter Project #1 Potential Driving Question: What is your vision for the future?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Employee Safety and Protection	● How are employees' health, safety and well-being protected? ● What local, state, and national agencies regulate employment conditions and practices? ● What organizations support employment in this field? ● What can a person do to protect their physical and mental health?	● Identify laws and regulations that protect the health, safety, and well-being of employees in this field. ● Identify local, state, and national agencies that regulate employment conditions and practices. ● Identify national, state, and local employment networks, organizations, or applicable unions. ● Summarize what current employees in the field recommend as best practices to protect physical and mental health. ● Identify how to mitigate what might be personal physical and mental health challenges.	**Written** ● Self-Assessment ● Class Assignments ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1,3 **Cluster Standards** MN 5 ST 3 **Pathway Standards** MN-PPD 3 MN-PRO 2	**ELA** 11-12 R 1,2,7 11-12 W 2,3,5,6,7 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6 **Literacy** 11-12 RST 2 11-12 WHST 2 **Math** **Science** **Computer Science and Digital Fluency**
Preparation for Internship: Applying and Interviewing	● Why are internships beneficial? ● How is an internship located and applied to? ● How does an employee convey professionalism in the workplace? ● How does an internship experience contribute to a professional portfolio? ● How is an internship obtained? ● How is an interview prepared for and conducted?	● Apply job search techniques to seek out, evaluate, and obtain internship opportunities. ● Communicate with industry/potential employers through the internship application experience. ● Explain the importance of professionalism and ethics in the workplace. ● Communicate effectively both verbally and in writing.	**Written** ● Self-Assessment ● Class Assignments ● Written Reflection ● Professional Portfolio **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1,4,8,10 **Cluster Standards** MN 4 ST 5,6 **Pathway Standards**	**ELA** 11-12 R 1 11-12 W 2,3 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6 **Literacy** 11-12 RST 2 11-12 WHST 2,3,4 **Math** **Science** **Computer Science and**

First Quarter Project #1 Potential Driving Question: What is your vision for the future?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		● Explain the importance of being prompt, being able to take directions and being motivated to accomplish assigned tasks. ● Document experiences and work samples. ● Demonstrate completion of any applications. ● Create questions for a potential interview. ● Critique other interviews and revise responses based on feedback.			**Digital Fluency**

Second Quarter Project #2 Potential Driving Question: How can data be used to predict outcomes of future events or to make decisions?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Trouble-Shooting: Failure Analysis	● What is semiconductor failure analysis (FA)? ● What are the 3 types of failure? ● What is micro probing? ● What are the steps or procedures (techniques) in a FA? ● What is the relationship between failure mode, failure mechanism, and root cause? ● Why is FA implemented? ● Why is documentation critical?	● Summarize the process of semiconductor failure analysis. ● Identify electrical failure, functional failure, parametric failure. ● Explain how micro probing can help identify a root cause. ● Describe FA techniques or series of procedures. ● Describe the relationship among failure mode, failure mechanism and root cause. ● Explain the importance of FA to knowing the cause of failure and how to prevent it in the future. ● Interpret any relevant manuals, specifications, schematics, diagrams, previous documentation logs. ● Apply FA to troubleshoot a device failure. ● Demonstrate documentation of the process.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 2,4,12 **Cluster Standards** MN 6 ST 1,2 **Pathway Standards** MN-MIR 3,4,5,6 MN-PPD 2,4 MN-PRO 1,3, MN-QA 1,2,3,6,7 ST-ET 1,2,3,4,5,6 ST-SM 2,4	**ELA** 11-12 R 1,2,4,7 11-12 W 2 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6 **Literacy** 11-12 RST 1,2,4,7,8,9 11-12 WHST 2 **Math** **Science** **Computer Science and Digital Fluency**
Trouble Shooting: Statistical Process Control **(OCC MAT 108)**	● What is Statistical Process Control (SPC)? ● What are basic statistical measurements? ● How are statistical measurements calculated? ● What are measures of distribution?	● Define statistical process controls as the use of statistical techniques to control the quality of a product or process. ● Define measures of center and other basic statistical terms.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments	**Career Ready Practices** CRP 2,4,8,12 **Cluster Standards** MN 6	**ELA** 11-12 R 1,2,4,7 11-12 W 2 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6 **Literacy**

Second Quarter Project #2 Potential Driving Question: How can data be used to predict outcomes of future events or to make decisions?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● What is the difference between normal and skewed distributions? ● What is linear regression? ● What are S-bar, R and proportion charts? ● What information do S-bar, R and proportion charts provide? ● How do technology tools help with calculations and display? ● How is SPC applied in semiconductor fabrication?	● Identity common symbols and abbreviations used in statistical calculations and interpretations. ● Demonstrate calculation of measures of center. ● Demonstrate calculation of measure of distribution. ● Compare and contrast normal and skewed distributions. ● Define linear regression. ● Summarize what information linear regression provides. ● Demonstrate calculation and interpretation of linear regression. ● Define S-bar, R, and proportion charts. ● Summarize the information provided by S-bar, R, and proportion charts. ● Determine what statistical tools to use given a set of data and questions. ● Demonstrate use of technology to perform statistical calculations. ● Demonstrate use of technology to create visual display (charts, graphs, models) of data. ● Demonstrate use of visual displays to explain interpretation of data. ● Explain the use of SPC in semiconductor fabrication.	● Teacher Observation/ Checklist	ST 1,2 **Pathway Standards** MN-QA 1,2, ST-ET 1,2,6 ST-SM 2,4	**Math** **Science** **Computer Science and Digital Fluency**

Second Quarter Project #2 Potential Driving Question: How can data be used to predict outcomes of future events or to make decisions?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Preparation for Internship: Preparing for Workforce	● How do I demonstrate readiness for future employment? ● What is the importance of good communication? ● What does it mean to be a professional? ● What is the role of an employee in this field? ● What is the importance of critical thinking to solving problems? ● Why is teamwork important? ● What are some important social issues of concern in the workplace?	● Describe what employers seek in an employee. ● Discuss professional standards and employability skills for roles within the semiconductor fabrication field. ● Describe the communication process, the importance of listening and speaking skills and their relationship to job performance. ● Describe the importance of good reading and writing skills and their relationship to job performance. ● Present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions. ● Discuss professional standards and employability skills, including the role of an employee in the robotics and automation field. ● Explain the importance of critical thinking and how to solve problems. ● Describe and demonstrate how to work in a team environment and how to be an effective leader.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection ● Professional Portfolio **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1,4,8,10,12 **Cluster Standards** MN 4 ST 6 **Pathway Standards**	**ELA** 11-12 W 2,3 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6 **Literacy** 11-12 RST 2,7 11-12 WHST 2,3,4 **Math** **Science** **Computer Science and Digital Fluency**

Second Quarter Project #2 Potential Driving Question: How can data be used to predict outcomes of future events or to make decisions?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		● Explain how to resolve conflicts with co-workers and supervisors. ● Explain how to give and receive constructive criticism. ● Demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results. ● Demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed. ● Identify and describe various social issues of concern in the workplace.			

Third Quarter Project #3 Potential Driving Question: What makes a successful internship experience?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Internship	● How does an internship experience contribute to employability? ● How do I function as a professional? ● How do I apply skills? ● In what ways, are practices and procedures different in an internship setting from the classroom/lab setting? ● What can I learn from professionals as they practice their craft? ● What are areas for improvement and challenge during the internship experience?	● Complete a 10-20 week internship with a local employer within the field of semiconductor fabrication or related industry. ● Communicate with industry/potential employers through the internship experience. ● Apply learned knowledge and skills to workplace situations. ● Explain the importance of professionalism and ethics in the workplace. ● Comply with workplace policies and regulations. ● Communicate effectively both verbally and in writing. ● Demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results. ● Demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed. ● Analyze and resolve problems that arise in completing assigned tasks.	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection ● Professional Portfolio **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist ● Supervisor Feedback	**Career Ready Practices** CRP 1,2,3,4,5,6,7,8,9,11,12 **Cluster Standards** ST 6 **Pathway Standards**	**ELA** 11-12 W 3 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6 **Literacy** 11-12 RST 1,2,4,7,8,9 11-12 WHST 2,3,4,5,6,7 **Math** **Science** **Computer Science and Digital Fluency**

Fourth Quarter Project #4 Potential Driving Question: How does design influence function/ practice and vice versa- how does function/practice influence design?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
Career Development and Employability	● What decisions do I need to make regarding post-secondary plans? ● How do I demonstrate my readiness for employment and/or further study? ● How do I demonstrate readiness for future employment? ● What is the importance of good communication? ● What does it mean to be a professional? ● What is the importance of critical thinking to solving problems? ● What is the importance of teamwork? ● What are some important social issues of concern in the workplace?	● Describe what employers seek in an employee. ● Describe the communication process, the importance of listening and speaking skills and their relationship to job performance. ● Describe the importance of good reading and writing skills and their relationship to job performance. ● Present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions. ● Seek employment opportunities as relevant for post-secondary. ● If pursuit of college degree is selected complete final documents for acceptance. ● Demonstrate understanding of the role of social media presence and the importance of the content and make any revisions as needed. ● Update resumes and cover letter/letter of interest with work and educational experiences, certifications, and work samples. ● Update portfolio. ● Demonstrate professional standards including oral	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1,3,4,5,8,9,10 **Cluster Standards** MN 4 ST 5 **Pathway Standards**	**ELA** 11-12 W 3 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6 **Literacy** 11-12 WHST 3,4 **Math** **Science** **Computer Science and Digital Fluency**

Fourth Quarter Project #4 Potential Driving Question: How does design influence function/ practice and vice versa- how does function/practice influence design?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment Evidence of Learning**	**CCTC Standards**	**NYS Standards**
		and written communication, leadership, teamwork appreciation for diversity, conflict management, customers service, work ethic, and adaptability.			
Internship Synthesis and Evaluation	● How do I function as a professional? ● How do I apply skills? ● In what ways, are practices and procedures different in an internship setting from the classroom/lab setting? ● What can I learn from professionals as they practice their craft? ● What are areas of improvement and challenge during the internship experience? ● How did the internship influence my thinking about future career goals?	● Synthesize and summarize learning from internship experience ● Evaluate learning from internship experience	**Written** ● Self-Assessment ● Class Assignments ● Tests/Quizzes ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist ● Supervisor Feedback	**Career Ready Practices** CRP 3,4,10	**ELA** 11-12 W 3 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6
				Cluster Standards ST 6	**Literacy** 11-12 WHST 3,4
				Pathway Standards	**Math**
					Science
					Computer Science and Digital Fluency
Extended Independent Project	● What is an area of study or a problem for focus of a deeper study (students may consider such topics of study such as deeper understanding of Internet of Things development, communication, and connectivity; further study of programming languages, or installation, configuration and troubleshooting of specific software packages; or network development, connectivity and communication; cybersecurity threats and mitigation).	● Articulate an area of interest for deeper study including topic and scope of study. ● Communicate scope and findings from independent project. ● Synthesize and summarize learning from extended project experience. ● Evaluate learning from extended learning experience.	**Written** ● Self-Assessment ● Class Assignments ● Written Reflection **Performance** ● Class Presentation ● Class Assignments ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 1,2,4,5,6,7,8,9,11,12	**ELA** 11-12 R 1,2,4,7,9 11-12 W 1,2,5,6,7 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6
				Cluster Standards MN 1,6 ST 1,2,4	**Literacy** 11-12 RST 1,2,3,4,5,6,7,8,9 11-12 WHST 1,2,3,4,5,6,7
				Pathway Standards MN-MIR 1,2,3,4,5,6 MN-PPD 1,2,3,4,5 MN-PRO 1,2,3,4,5	**Math**
					Science

Fourth Quarter Project #4 Potential Driving Question: How does design influence function/ practice and vice versa- how does function/practice influence design?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment** **Evidence of Learning**	**CCTC Standards**	**NYS Standards**
	● What knowledge and skills will be developed or enhanced? ● How is a project proposal written? ● What is necessary to implement an individual or small group project? ● What was learned from the project? ● What would be done differently? ● What contributed to success? ● How effective was the design or plan? ● How effective was implementation? ● How effective was set-up procedures? ● How effective was integration with other team members or mentors? ● How were any problems solved and what might be alternative solutions?			MN-QA 1,2,3,4,5,6,7 ST-ET 1,2,3,4,5,6 ST-SM 1,2,3,4	**Computer Science and Digital Fluency**
Reflection	● What are my next steps? ● What will help attain goals?	● Articulate future goals and plans. ● Identify steps to attain future goals and plans. ● Update resume, professional portfolio, and employability profile.	**Written** ● Self-Assessment ● Written Reflection **Performance** ● Class Presentation ● Teacher Observation/ Checklist	**Career Ready Practices** CRP 10	**ELA** 11-12 W 3 11-12 SL 1,2,3,4,5,6 11-12 L 1,2,3,4,6
				Cluster Standards MN 4 ST 5	**Literacy** 11-12 WHST 3
				Pathway Standards	**Math**
					Science
					Computer Science and Digital Fluency

Fourth Quarter Project #4 Potential Driving Question: How does design influence function/ practice and vice versa- how does function/practice influence design?					
Unit	**Key Questions**	**Key Learning Targets** **(Students will know and be able to:)**	**Assessment** **Evidence of Learning**	**CCTC Standards**	**NYS Standards**

CCTC: Common Career and Technical Core
Career Ready Practices

1	**Act as a responsible and contributing citizen and employee.**
2	**Apply appropriate academic and technical skills.**
3	**Attend to personal health and financial well-being.**
4	**Communicate clearly and effectively and with reason.**
5	**Consider the environmental, social, and economic impacts of decisions.**
6	**Demonstrate creativity and innovation.**
7	**Employ valid and reliable research strategies.**
8	**Utilize critical thinking to make sense of problems and persevere in solving them.**
9	**Model integrity, ethical leadership, and effective management.**
10	**Plan education and career paths aligned to personal goals.**
11	**Use technology to enhance productivity.**
12	**Work productively in teams while using cultural global competence.**

Full text: CareerReadyPractices-FINAL.pdf (careertech.org)

CCTC: Common Career and Technical Core
Career Cluster and Pathway Standards for Manufacturing

Area	Number	Standard
Career Cluster: Manufacturing	**MN 1**	Evaluate the nature and scope of the Manufacturing Career Custer and the role of manufacturing in society and in the economy.
	MN 2	Analyze and summarize how manufacturing businesses improve performance.
	MN 3	Comply with federal, state, and local regulations to ensure worker safety and health and environmental work practices.
	MN 4	Describe career opportunities and means to achieve those opportunities in each of the Manufacturing Career Pathways.
	MN 5	Describe government policies and industry standards that apply to manufacturing.
	MN 6	Describe workplace knowledge and skills common to manufacturing.
Career Pathway: Maintenance, Installation & Repair Career Pathway (MN-MIR)	**MN-MIR 1**	Demonstrate maintenance skills and proficient operation of equipment to maximize manufacturing performance.
	MN-MIR 2	Demonstrate the safe use of manufacturing equipment to ensure a safe and healthy environment.
	MN-MIR 3	Diagnose equipment problems and effectively repair manufacturing equipment.
	MN-MIR 4	Investigate and employ techniques to maximize manufacturing equipment performance.
	MN-MIR 5	Implement a preventative maintenance schedule to maintain manufacturing equipment, tools and workstations.
	MN-MIR 6	Implement a preventative maintenance schedule to maintain manufacturing equipment, tools and workstations.
Career Pathway: Manufacturing Production Process Development Career Pathway (MN-PPD)	**MN-PPD 1**	Produce quality products that meet manufacturing standards and exceed customer satisfaction.
	MN-PPD 2	Research, design and implement alternative manufacturing processes to manage production of new and/or improved products.
	MN-PPD 3	Monitor, promote and maintain a safe and productive workplace using techniques and solutions that ensure safe production of products.
	MN-PPD 4	Implement continuous improvement processes in order to maintain quality within manufacturing production.
	MN-PPD 5	Develop procedures to create products that meet customer needs.
Career Pathway: Production Career Pathway (MN-PRO)	**MN-PRO 1**	Diagnose production process problems and take corrective action to meet production quality standards.
	MN-PRO 2	Manage safe and healthy production working conditions and environmental risks.
	MN-PRO 3	Make continuous improvement recommendations based on results of production process audits and inspections.
	MN-PRO 4	Coordinate work teams when producing products to enhance production process and performance.
	MN-PRO 5	Demonstrate the safe use of manufacturing equipment.
Career Pathway: Quality Assurance Career Pathway (MN-QA)	**MN-QA 1**	Evaluate production operations for product and process quality.
	MN-QA 2	Recommend and implement continuous improvement in manufacturing processes.
	MN-QA 3	Coordinate work teams to create a product that meets quality assurance standards.
	MN-QA 4	Employ project management processes using data and tools to deliver quality, value-added products.
	MN-QA 5	Perform safety inspections and training to ensure a safe and healthy workplace.
	MN-QA 6	Implement continuous improvement processes to maintain quality products.
	MN-QA 7	Identify inspection processes that ensure products meet quality specifications.

CCTC: Common Career and Technical Core
Career Cluster and Pathway Standards for Science, Technology, Engineering and Mathematics

Area	Number	Standard
Career Cluster: **Science, Technology, Engineering & Mathematics Career Cluster**	**ST-1**	Apply engineering skills in a project that requires project management, process control and quality assurance.
	ST-2	Use technology to acquire, manipulate, analyze and report data.
	ST-3	Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.
	ST-4	Understand the nature and scope of the Science, Technology, Engineering & Mathematics Career Cluster and the role of STEM in society and the economy.
	ST-5	Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways.
	ST-6	Demonstrate technical skills needed in a chosen STEM field.
Career Pathway: **Engineering & Technology Career Pathway (ST-ET)**	**ST-ET-1**	Use STEM concepts and processes to solve problems involving design and/or production.
	ST-ET-2	Display and communicate STEM information.
	ST-ET-3	Apply processes and concepts for the use of technological tools in STEM.
	ST-ET-4	Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.
	ST-ET-5	Apply the elements of the design process.
	ST-ET-6	Apply the knowledge learned in STEM to solve problems.
	ST-ET-7	
Career Pathway: **Science and Math Career Pathway (ST-SM)**	**ST-SM-1**	Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.
	ST-SM-2	Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
	ST-SM-3	Analyze the impact that science and mathematics has on society.
	ST-SM- 4	Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

Full text for: **Manufacturing:** MN-CCTC_PerformanceElements.pdf (careertech.org)
Science, Technology, Engineering and Mathematics: ST-CCTC_PerformanceElements.pdf (careertech.org)

New York State Standards for ELA and Literacy

NYS ELA Standards

9th-10th Grade Reading Standards (Literary and Informational Text)

Key Ideas and Details	
9-10R1	Cite strong and thorough textual evidence to support analysis of what the text says explicitly/implicitly and make logical inferences; develop questions for deeper understanding and for further exploration. (RI&RL)
9-10R2	Determine one or more themes or central ideas in a text and analyze its development, including how it emerges and is shaped and refined by specific details; objectively and accurately summarize a text. (RI&RL)
9-10R3	Analyze how and why individuals, events, and ideas develop and interact over the course of a text. In literary texts, analyze how complex and/or dynamic characters develop, interact with other characters, advance the plot, or develop a theme. (RL) In informational texts, analyze how the author unfolds an analysis or argument, including the sequence, the introduction and development of ideas, and the connections that exist. (RI)
Craft and Structure	
9-10R4	Determine the meaning of words and phrases as they are used in a text, including figurative and connotative meanings. Analyze the impact of specific word choices on meaning, tone, and mood. Examine technical or key terms and how language differs across genres. (RI&RL)
9-10R5	In literary texts, consider how varied aspects of structure create meaning and affect the reader. (RL) In informational texts, consider how author's intent influences particular sentences, paragraphs, or sections. (RI)
9-10R6	Analyze how authors employ point of view, perspective, and purpose to shape explicit and implicit messages (e.g., examine rhetorical strategies, literary elements, and devices). (RI&RL)
Integration of Knowledge and Ideas	
9-10R7	Analyze how a subject / content is presented in two or more formats by determining which details are emphasized, altered, or absent in each account. (e.g., analyze the representation of a subject / content or key scene in two different formats, examine the differences between a historical novel and a documentary). (RI&RL)
9-10R8	Delineate and evaluate an argument and specific claims in a text, assessing the validity or fallacy of key statements by examining whether the supporting evidence is relevant and sufficient. (RI&RL)
9-10R9	Choose and develop criteria in order to evaluate the quality of texts. Make connections to other texts, ideas, cultural perspectives, eras, and personal experiences. (RI&RL)

9th-10th Grade Writing Standards

Text Types and Purposes	
9-10W1	Write arguments to support claims that analyze substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
9-10W2	Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
9-10W3	Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.
9-10W4	Create a poem, story, play, art work, or other response to a text, author, theme, or personal experience; demonstrate knowledge and understanding of a variety of techniques and genres. Explain divergences from the original when appropriate.
9-10W5	Draw evidence from literary or informational texts to support analysis, reflection, and research. Apply grade 9/10 Reading standards to both literary and informational text, where applicable.
Research to Build and Present Knowledge	
9-10W6	Conduct research to answer questions, including self-generated questions, or solve a problem; narrow or broaden the inquiry when appropriate. Synthesize multiple sources, demonstrating understanding of the subject under investigation.
9-10W7	Gather relevant information from multiple sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas; avoid plagiarism and follow a standard format for citation.

9th-10th Grade Speaking and Listening

Comprehension and Collaboration	
9-10SL1	Initiate and participate effectively in a range of collaborative discussions with diverse partners on complex topics, texts, and issues; express ideas clearly and persuasively, and build on those of others.
9-10SL2	Integrate multiple sources of information presented in diverse formats (e.g., including visual, quantitative, and oral), evaluating the credibility, accuracy, and relevance of each source.
9-10SL3	Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric; identify any fallacious reasoning or exaggerated or distorted evidence.
Presentation of Knowledge and Ideas	
9-10SL4	Present claims, findings, and supporting evidence clearly, concisely, and logically; organization, development, substance, and style are appropriate to task, purpose, and audience.
9-10SL5	Make strategic use of digital media and/or visual displays in presentations to enhance understanding of findings, reasoning, and evidence, and to add elements of interest to engage the audience.
9-10SL6	Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.

9th-10th Grade Language Standards

Conventions of Academic English	
Anchor L1	Demonstrate command of the conventions of academic English grammar and usage when writing or speaking*.
Anchor L2	Demonstrate command of the conventions of academic English capitalization, punctuation, and spelling when writing*
Knowledge of Language	
9-10L3	Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.
Vocabulary Acquisition and Use	
9-10L4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases, choosing flexibly from a range of strategies.
9-10L5	Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.
9-10L6	Acquire and accurately use general academic and content-specific words and phrases, sufficient for reading, writing, speaking, and listening; demonstrate independence in applying vocabulary knowledge when considering a word or phrase important to comprehension or expression.

Core Conventions Skills for Grades 9-12
- Use parallel structure.
- Use various types of phrases and clauses to add variety and interest to writing or presentations.
- Understand that usage is a matter of convention that can change over time.
- Resolve issues of complex or contested usage, consulting references as needed.

Core Punctuation and Spelling Skills for Grades 9-12
- Use punctuation (commas, parentheses, dashes, hyphens) to clarify and enhance writing.
- Use a semicolon to link two or more closely related independent clauses.
- Use a colon to introduce a list or quotation.

11th-12th Grade Reading Standards (Literary and Informational Text)

Key Ideas and Details	
11-12R1	Cite strong and thorough textual evidence to support analysis of what the text says explicitly/implicitly and make logical inferences, including determining where the text is ambiguous; develop questions for deeper understanding and for further exploration. (RI&RL)
11-12R2	Determine two or more themes or central ideas in a text and analyze their development, including how they emerge and are shaped and refined by specific details; objectively and accurately summarize a complex text. (RI&RL)
11-12R3	In literary texts, analyze the impact of author's choices. (RL) In informational texts, analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop. (RI)
Craft and Structure	
11-12R4	Determine the meaning of words and phrases as they are used in a text, including figurative and connotative meanings. Analyze the impact of specific word choices on meaning, tone, and mood, including words with multiple meanings. Analyze how an author uses and refines the meaning of technical or key term(s) over the course of a text. (RI&RL)
11-12R5	In literary texts, analyze how varied aspects of structure create meaning and affect the reader. (RL) In informational texts, analyze the impact and evaluate the effect structure has on exposition or argument in terms of clarity, persuasive/rhetorical technique, and audience appeal. (RI)
11-12R6	Analyze how authors employ point of view, perspective, and purpose, to shape explicit and implicit messages (e.g., persuasiveness, aesthetic quality, satire, sarcasm, irony, or understatement). (RI&RL)
Integration of Knowledge and Ideas	
11-12R7	In literary texts, analyze multiple adaptations of a source text as presented in different formats (e.g., works of art, graphic novels, music, film, etc.), specifically evaluating how each version interprets the source. (RL) In informational texts, integrate and evaluate sources on the same topic or argument in order to address a question, or solve a problem. (RI)
11-12R8	Delineate and evaluate an argument in applicable texts, applying a lens (e.g. constitutional principles, logical fallacy, legal reasoning, belief systems, codes of ethics, philosophies, etc.) to assess the validity or fallacy of key arguments, determining whether the supporting evidence is relevant and sufficient. (RI&RL)
11-12R9	Choose and develop criteria in order to evaluate the quality of texts. Make connections to other texts, ideas, cultural perspectives, eras, and personal experiences. (RI&RL)

11th-12th Grade Writing Standards

Text Types and Purposes	
11-12W1	Write arguments to support claims that analyze substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
11-12W2	Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
11-12W3	Write narratives to develop real or imagined experiences or events using effective techniques, well-chosen details, and well-structured event sequences.
11-12W4	Create a poem, story, play, art work, or other response to a text, author, theme, or personal experience; demonstrate knowledge and understanding of a variety of techniques and genres. Explain connections between the original and the created work.
11-12W5	Draw evidence from literary or informational texts to support analysis, reflection, and research. Apply grade 11/12 Reading standards to both literary and informational text, where applicable.
Research to Build and Present Knowledge	
11-12W6	Conduct research through self-generated question, or solve a problem; narrow or broaden the inquiry when appropriate. Synthesize multiple sources, demonstrating understanding and analysis of the subject under investigation.
11-12W7	Gather relevant information from multiple sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas; avoid plagiarism, overreliance on one source, and follow a standard format for citation.

11th-12th Grade Speaking and Listening

Comprehension and Collaboration	
11-12SL1	Initiate and participate effectively in a range of collaborative discussions with diverse partners on complex topics, texts, and issues; express ideas clearly and persuasively, and build on those of others.
11-12SL2	Integrate multiple sources of information presented in diverse formats (e.g., including visual, quantitative, and oral). Evaluate the credibility and accuracy of each source, and note any discrepancies among the data to make informed decisions and solve problems.
11-12SL3	Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric; assess the premises and connections among ideas, diction, and tone.
Presentation of Knowledge and Ideas	
11-12SL4	Present claims, findings, and supporting evidence, conveying a clear and distinct perspective; alternative or opposing perspectives are addressed; organization, development, substance, and style are appropriate to task, purpose, and audience.
11-12SL5	Make strategic use of digital media and/or visual displays in presentations to enhance understanding of findings, reasoning, and evidence, and to add elements of interest to engage the audience.
11-12SL6	Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate.

11th-12th Grade Language Standards

Conventions of Academic English	
Anchor L1	Demonstrate command of the conventions of academic English grammar and usage when writing or speaking*.
Anchor L2	Demonstrate command of the conventions of academic English capitalization, punctuation, and spelling when writing*
Knowledge of Language	
11-12L3	Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.
Vocabulary Acquisition and Use	
11-12L4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases, choosing flexibly from a range of strategies.
11-12L5	Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.
11-12L6	Acquire and accurately use general academic and content-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in applying vocabulary knowledge when considering a word or phrase important to comprehension or expression.

Core Conventions Skills for Grades 9-12
- Use parallel structure.
- Use various types of phrases and clauses to add variety and interest to writing or presentations.
- Understand that usage is a matter of convention that can change over time.
- Resolve issues of complex or contested usage, consulting references as needed.

Core Punctuation and Spelling Skills for Grades 9-12
- Use punctuation (commas, parentheses, dashes, hyphens) to clarify and enhance writing.
- Use a semicolon to link two or more closely related independent clauses.
- Use a colon to introduce a list or quotation.

Full text: New York State Next Generation English Language Arts Learning Standards (nysed.gov)

NYS Literacy Standards: NYS Next Generation 6-12 Literacy Standards in History/Social Studies, Science, and Technical Subjects

Reading Standards for Literacy in Science and Technical Subjects 9-10	
RST 1	Cite specific evidence to support analysis of scientific and technical texts, charts, diagrams, etc. attending to the precise details of the source. Understand and follow a detailed set of directions.
RST 2	Determine the key ideas or conclusions of a source; trace the source's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the source.
RST 3	Analyze how and why scientific ideas and reasoning are developed and modified over the course of a text, source, argument, etc. Craft and Structure
RST 4	Determine the meaning of symbols, key terms, and other content-specific words and phrases as they are used in scientific or technical sources; describe how the inclusion of charts, graphs, diagrams, data influence conclusion(s).
RST 5	Describe how the text structures information or ideas into categories or hierarchies, including how the major sections contribute to the whole and to an understanding of the topic.
RST 6	Describe purpose and/or point of view when an author is presenting information, describing a procedure, discussing an experiment, etc. Integration of Knowledge and Ideas
RST 7	Translate scientific or technical information expressed as written text into visual form (e.g., a table or chart), and translate information expressed visually or mathematically (e.g., in an equation) into words.
RST 8	Assess the extent to which the reasoning and evidence in a source support the author's claim or a recommendation for solving a scientific or technical problem.
RST 9	Compare and contrast findings presented in a source to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 9-10	
WHST 1	Write arguments focused on discipline-specific content.
WHST 2	Write informative/explanatory text focused on discipline-specific content.
WHST 3	Write narratives to understand an event or topic, appropriate to discipline-specific norms, conventions, and tasks.
WHST 4	Write responses to texts and to events (past and present), ideas, and theories that include personal, cultural, and thematic connections.
WHST 5	Conduct short as well as more sustained research projects to answer a question (including a self-generated question), analyze a topic, or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
WHST 6	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question and the accuracy of each source by applying discipline-specific criteria; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
WHST 7	Draw evidence from informational texts to support analysis, reflection, and research.

Full text: New York State Next Generation English Language Arts Learning Standards (nysed.gov)

NYS Literacy Standards: NYS Next Generation 6-12 Literacy Standards in History/Social Studies, Science, and Technical Subjects

Reading Standards for Literacy in Science and Technical Subjects 11-12	
RST 1	Cite specific evidence to support analysis of scientific and technical texts, charts, diagrams, etc. attending to the precise details of the source, and attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
RST 2	Determine the key ideas or conclusions of a source; summarize complex concepts, processes, or information presented in a source by paraphrasing in precise and accurate terms.
RST 3	Analyze how and why scientific ideas and reasoning are developed and modified over the course of a text, source, argument, etc.; analyze/evaluate the results and conclusions based on explanations in the text.
RST 4	Determine the meaning of symbols, key terms, and other content-specific words and phrases as they are used in scientific or technical sources.
RST 5	Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
RST 6	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
RST 7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
RST 8	Evaluate the data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
RST 9	Compare and contrast findings presented in a source to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 11-12	
WHST 1	Write arguments focused on discipline-specific content.
WHST 2	Write explanatory and analytical text focused on discipline-specific content and which uses strategies for conveying information like those used in the respective discipline.
WHST 3	Write narratives to understand an event or topic, appropriate to discipline-specific norms, conventions, and tasks.
WHST 4	Write responses to texts and to events (past and present), ideas, and theories that include personal, cultural, and thematic connections.
WHST 5	Conduct short as well as more sustained research projects to answer a question (including a self-generated question), analyze a topic, or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
WHST 6	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience as well as by applying discipline-specific criteria used in the social sciences or sciences; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
WHST 7	Draw evidence from informational texts to support analysis, reflection, and research.

Full text: New York State Next Generation Learning Standards for Literacy in History/Social Studies, Science and Technical Subjects (nysed.gov)