



# GEORGIA

PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

## ENGINEERING & TECHNOLOGY

**PATHWAY:** Manufacturing

**COURSE:** Robotics and Automated Systems

**UNIT:** 9-CIM, CAM, & CNC



## INTRODUCTION

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**Annotation:** In this unit students will discover how computers are integrated into manufacturing to control equipment.

**Grade(s):**

<input type="checkbox"/>	9 <sup>th</sup>
<input checked="" type="checkbox"/>	10 <sup>th</sup>
<input checked="" type="checkbox"/>	11 <sup>th</sup>
<input checked="" type="checkbox"/>	12 <sup>th</sup>

**Time:** 20 hours

**Author:** Emil L. Decker

**Additional Author(s):**

**Students with Disabilities:**

For students with disabilities, the instructor should refer to the student's IEP to be sure that the accommodations specified are being provided. Instructors should also familiarize themselves with the provisions of Behavior Intervention Plans that may be part of a student's IEP. Frequent consultation with a student's special education instructor will be beneficial in providing appropriate differentiation.



## FOCUS STANDARDS

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### GPS Focus Standards:

ENGR-RAS-1. Students will explain the history of automated systems and the benefits of those systems to manufacturing in a global society.

ENGR-RAS-2. Students will identify and explain the major engineering tasks in organizing automated manufacturing.

ENGR-RAS-3. Students will discuss the systems and applications of automation including: AGV, PLC, CNC, CIM, CAD, CAM, and robotics as essential to succeeding globally in a manufacturing market.

ENGR-RAS-4. Students will outline the utilization of programmable control devices and data transfer.

ENGR-RAS-5. Students will apply the principles of PLC, CIM, CAD, CAM, and robotics in the manufacturing of a product.

ENGR-STEM-1. Students will recognize the systems, components, and processes of a technological system.

ENGR-STEM-2. Students will identify the impact of engineering and technology within global, economic, environmental, and societal contexts.

ENGR-STEM-3. Students will design technological problem solutions using scientific investigation, analysis and interpretation of data, innovation, invention, and fabrication while considering economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability constraints.

ENGR-STEM-4. Students will apply principles of science, technology, engineering, mathematics, interpersonal communication, and teamwork to the solution of technological problems.

ENGR-STEM-5. Students will select and demonstrate techniques, skills, tools, and understanding related to energy and power, bio-related, communication, transportation, manufacturing, and construction technologies.

ENGR-STEM-6. Students will enhance reading by developing vocabulary and comprehension skills associated with text materials, problem descriptions, and laboratory activities associated with engineering and technology education.

### GPS Academic Standards:

*SCSh7. Students will analyze how scientific knowledge is developed.*

*SCSh3. Students will identify and investigate problems scientifically.*

*SCSh5. Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.*

*SCSh6. Students will communicate scientific investigations and information clearly.*

*MM3P3. Students will communicate mathematically.*

*MM3P4. Students will make connections among mathematical ideas and to other disciplines.*

*MM3P5. Students will represent mathematics in multiple ways.*

### National / Local Standards / Industry / ISTE:



## UNDERSTANDINGS & GOALS

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### Enduring Understandings:

- Students will understand the advantages, concepts, and procedures involved in using computers to control machine processing in manufacturing locations.

### Essential Questions:

- What does CIM, CNC, and CAM stand for?
- What is an M Code? What is a G Code?
- What are the basic differences between a CNC lathe and a CNC milling machine?
- What are some reasons for computer integrated manufacturing?

### Knowledge from this Unit:

- Students will define relevant vocabulary related to computer controlled manufacturing
- Students will discover the basics of CNC milling and lathe programming code.
- Students will become acquainted with the procedural steps involved in computer integrated manufacturing.

## Skills from this Unit:



# ASSESSMENT(S)

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**Assessment Method Type:** Select one or more of the following. Please consider the type(s) of differentiated instruction you will be using in the classroom.

- ☒ Pre-test
- ☐ Objective assessment - multiple-choice, true- false, etc.
  - ☐ Quizzes/Tests
  - ☐ Unit test
- ☒ Group project
- ☒ Individual project
- ☐ Self-assessment - May include practice quizzes, games, simulations, checklists, etc.
  - ☐ Self-check rubrics
  - ☐ Self-check during writing/planning process
  - ☐ Journal reflections on concepts, personal experiences and impact on one's life
  - ☐ Reflect on evaluations of work from teachers, business partners, and competition judges
  - ☐ Academic prompts
  - ☐ Practice quizzes/tests
- ☒ Subjective assessment/Informal observations
  - ☐ Essay tests
  - ☒ Observe students working with partners
  - ☐ Observe students role playing
- ☐ Peer-assessment
  - ☐ Peer editing & commentary of products/projects/presentations using rubrics
  - ☐ Peer editing and/or critiquing
- ☒ Dialogue and Discussion
  - ☐ Student/teacher conferences
  - ☒ Partner and small group discussions
  - ☒ Whole group discussions
  - ☐ Interaction with/feedback from community members/speakers and business partners
- ☒ Constructed Responses
  - ☐ Chart good reading/writing/listening/speaking habits
  - ☒ Application of skills to real-life situations/scenarios
- ☐ Post-test

**Assessment(s) Title:**

**Assessment(s) Description/Directions:**

**Attachments for Assessment(s):**



## LEARNING EXPERIENCES

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### Sequence of Instruction

1. **Identify the Standards.** Standards should be posted in the classroom for each lesson.
2. **Review Essential Questions.**
3. **Identify and review the unit vocabulary.**
4. **Assessment Activity.**

#### Step 1:

Discuss the use of Computer aided milling machines, lathes, and other methods of controlling manufacturing equipment. (see *CIM Part 1.ppt* & *CIM Part 2.ppt*)

#### Step 2:

Demonstrate basic CNC milling concepts using class equipment, or have students create CNC trainers as described and used in CNC Milling Exercise (see *CNC Milling Exercise.doc*)

#### Step 3:

Use CNC Vocabulary List to provide reinforcement on key vocabulary terms. Use Crossword puzzle to reinforce key terms. (see *CNC Vocab.doc* & *CIM Crossword.doc*)

#### Step 4:

Using class equipment, or the homebuilt CNC trainer, have students use CNC codes to write and run a CNC program. (see *CNC Codes.doc*)

### Attachments for Learning Experiences:

#### Notes & Reflections:

Labs with CNC, CIM, and or PLC trainers will find sufficient materials within their trainers to cover this chapter. Labs without equipment will want to cover the basic concepts of Numeric control and computer control integration using tools such as the *CNC Milling Exercise.doc*

Knowledge of, and familiarity with the vocabulary terms, geometric relationships and coordinate systems are basic to all computer integrated manufacturing. These should be stressed regardless of equipment availability.



## CULMINATING PERFORMANCE TASK (Optional)

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### Culminating Unit Performance Task Title:

CNC Programming

### Culminating Unit Performance Task Description/Directions/Differentiated Instruction:

Students use CNC equipment to write and run a CNC program successfully

### Attachments for Culminating Performance Task:



## UNIT RESOURCES

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**Web Resources:**

**Attachment(s):**

**Materials & Equipment:**

**What 21st Century Technology was used in this unit?**

<input checked="" type="checkbox"/>	Slide Show Software	<input type="checkbox"/>	Graphing Software	<input type="checkbox"/>	Audio File(s)
<input type="checkbox"/>	Interactive Whiteboard	<input type="checkbox"/>	Calculator	<input type="checkbox"/>	Graphic Organizer
<input type="checkbox"/>	Student Response System	<input type="checkbox"/>	Desktop Publishing	<input type="checkbox"/>	Image File(s)
<input type="checkbox"/>	Web Design Software	<input type="checkbox"/>	Blog	<input type="checkbox"/>	Video
<input type="checkbox"/>	Animation Software	<input type="checkbox"/>	Wiki	<input type="checkbox"/>	Electronic Game or Puzzle Maker
<input type="checkbox"/>	Email	<input checked="" type="checkbox"/>	Website		