GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

ENGINEERING & TECHNOLOGY

PATHWAY: Manufacturing

COURSE: Robotics and Automated System

UNIT: 11-Project Management

# INTRODUCTION

**Annotation:**

In this unit students will develop and follow a detailed plan for the solution of a design problem in automation manufacturing. They will produce flow charts and timelines, design work cells, and apply their collective knowledge of automation technology together with their problem solving skills to create and demonstrate the effectiveness of their design plans. A focus on collaboration and teamwork is appropriate for evaluation.

**Grade(s):**

| | |
|---|---|
| | 9th |
| x | 10th |
| x | 11th |
| x | 12th |

**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

### 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.
**ENGR-STEM-7**. Students will develop leadership and interpersonal problem-solving skills through participation in co-curricular activities associated with the Technology Student Association.

### GPS Academic Standards:

*MM3P3.* Students will communicate mathematically.
*MM3P5.* Students will represent mathematics in multiple ways.
*SCSh6.* Students will communicate scientific investigations and information clearly.

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

# UNDERSTANDINGS & GOALS

### Enduring Understandings:

- Students will develop and follow a detailed plan for the solution of a design problem.

### Essential Questions:

- What role does teamwork and collaboration play in developing a scenario for an automated work cell?
- What are the major components of your work cell and what should a complete cycle of operation look like?
- What part do flowcharts, timelines, resources, and problem solving have in your work cell?
- How could you improve your design, given more time and / or materials?

### Knowledge from this Unit:

- Students will utilize robotic, CIM, CNC, and other components integrated appropriately to create a simple work cell

### Skills from this Unit:

- Students will work individually or in teams (preferred)

# ASSESSMENT(S)

**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
- x Group project
- ____ Individual project
- x Self-assessment - May include practice quizzes, games, simulations, checklists, etc.
  - __ Self-check rubrics
  - _x_ Self-check during writing/planning process
  - _x_ 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
- x Subjective assessment/Informal observations
  - __ Essay tests
  - _x_ Observe students working with partners
  - _x_ Observe students role playing
- x Peer-assessment
  - _x_ Peer editing & commentary of products/projects/presentations using rubrics
  - _x_ Peer editing and/or critiquing
- x Dialogue and Discussion
  - _x_ Student/teacher conferences
  - _x_ Partner and small group discussions
  - _x_ Whole group discussions
  - __ Interaction with/feedback from community members/speakers and business partners
- x Constructed Responses
  - __ Chart good reading/writing/listening/speaking habits
  - _x_ Application of skills to real-life situations/scenarios
- ____ Post-test

**Assessment(s) Title:**

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

**Attachments for Assessment(s):**

# LEARNING EXPERIENCES

## 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 final project with students. Project design and functionality will be determined partly based on the individual students' own problem description, available equipment, and time. Possible alternatives, options, and limitations should be acknowledged, but not perceived as an insurmountable barrier to students. Encouragement and guidance is recommended, but remember to let the students determine their project's goals and milestones.

**Step 2:**
Have students view appropriate examples of successful projects, such as those listed in the supplemental resources listed above.

**Step 3:**
Have students create flowcharts, timelines, resource lists, etc. as necessary to achieve their design. Students should also create a grading rubric to allow for self, peer, and instructor evaluation of their project.

**Step 4:**
Create project

**Step 5:**
Evaluate project

## Attachments for Learning Experiences:

## Notes & Reflections:

Projects may be a new work cell, robot programming, or even an extension of previous work, such as an extension of a previous project.

One option might be to allow them to expand upon the robotics game they worked upon in Unit 10. Hosting a tournament, with all the various behind the scene aspects most often taken for granted is a daunting task, but very rewarding.

Work cell projects can not only be fun, but can be used in conjunction with fundraising efforts, or TSA / SkillsUSA, or appropriate CTSO competitions.

The greatest emphasis must be placed on time management. Many grandiose projects might work, but if time runs out, how can you determine if the goals of the project were met or not?

Proper planning, as demonstrated with the "up-front" paperwork can seem like a delay to students ready to jump on their projects, but good prior planning can really save time. This cannot be stressed enough.

Having rubrics developed before they start the actual construction of a project will help keep them on track. If a project takes a major turn, or must be abandoned, do not let the students despair and quit. Remind them of T. A.

Edison and the number of elements he tried before his lightbulb worked. Allow students to rework their rubrics if it is obvious that the current rubric is no longer appropriate for the project.

Size of groups might be determined by the scope of the project, the available equipment, time available, or the amount of guidance the instructor wishes to impose. Ensure that all students are given an opportunity to participate, allowing them to show their mastery of skills and knowledge acquired.

## CULMINATING PERFORMANCE TASK (Optional)

**Culminating Unit Performance Task Title:**

Automation & Robotic Final Work Cell Project

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

Students will produce an automated work cell designed to manufacture, sort, test, package, or provide some other process to resources to achieve an end product.

**Attachments for Culminating Performance Task:**

*(See Project.doc)*

## UNIT RESOURCES

**Web Resources:**

http://www.education.rec.ri.cmu.edu/roboticscurriculum/vex_online/curriculum/engineering_101/activities/videos/Lego_Rube_Goldberg.html

http://www.education.rec.ri.cmu.edu/roboticscurriculum/vex_online/curriculum/advanced_applications/work_cell.html

http://www.education.rec.ri.cmu.edu/roboticscurriculum/vex_online/curriculum/engineering_101/activities/videos/hot_dog.html

**Attachment(s):**

**Materials & Equipment:**

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

| | | | | | |
|---|---|---|---|---|---|
| | Slide Show Software | | Graphing Software | | Audio File(s) |
| | Interactive Whiteboard | | Calculator | | Graphic Organizer |
| | Student Response System | | Desktop Publishing | | Image File(s) |
| | Web Design Software | | Blog | x | Video |
| | Animation Software | | Wiki | | Electronic Game or Puzzle Maker |
| | Email | x | Website | | |