GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

ENGINEERING AND TECHNOLOGY

PATHWAY: Manufacturing

COURSE: Robotics and Automation

UNIT: Teleoperated Electronic Control

INTRODUCTION

Annotation:

Students will show understanding of basic terms and concepts related to transmission and reception of wireless signals.

Grade(s):

	9th
X	10th
X	11th
X	12th

Time:

5 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-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-STEM-1. Students will recognize the systems, components, and processes of a technological system.
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.
ITEA - Standard 2. Students will develop an understanding of the core concepts of technology.
ITEA - 9. Students will develop an understanding of engineering design.
ITEA - 17. Students will develop an understanding of and be able to select and use information and communication technologies.
ITEA - 19. Students will develop an understanding of and be able to select and use manufacturing technologies.

GPS Academic Standards:

SCSh3. Students will identify and investigate problems scientifically.
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

Enduring Understandings:

Students will understand how remote controlled systems work. They will also understand how these systems have affected the development of manufacturing technology in the past and how they will continue to improve technology in the future.

Essential Questions:

What is a radio transmitter?
What important lesson was learned from the happening at Tacoma Narrows Bridge?

Knowledge from this Unit:

Define oscillation, resonance, electromagnetic wave, and other key terms.
Outline the purpose of crystals, and how they work.
List some different antenna types, shapes and sizes, and their applications
Describe how transmitters and receivers work

Skills from this Unit:

Students will be able to construct and operate a basic radio receiver.
Students will use teleoperated robots in a variety of settings to determine the effectiveness of wireless remote control in those environments.

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.

- x Pre-test
- ____ Objective assessment - multiple-choice, true- false, etc.
  - __ Quizzes/Tests
  - _x_ Unit test
- x Group project
- ____ Individual project
- x Self-assessment - May include practice quizzes, games, simulations, checklists, etc.
  - _x_ 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
- x Subjective assessment/Informal observations
  - __ Essay tests
  - _x_ 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
- x Dialogue and Discussion
  - __ Student/teacher conferences
  - __ Partner and small group discussions
  - _x_ Whole group discussions
  - __ Interaction with/feedback from community members/speakers and business partners
- ____ Constructed Responses
  - __ Chart good reading/writing/listening/speaking habits
  - _x_ Application of skills to real-life situations/scenarios
- x Post-test

Assessment(s) Title:

Transmitters and Receivers Test *(see Tx & Rx.rtf; .zip; or .tst)*

Assessment(s) Description/Directions:

Students will show understanding of basic terms and concepts related to transmission and reception of wireless signals.

Attachments for Assessment(s):

- Vex transmit / receive. If this online curriculum sample is still available, it is the best explanation of how it works reference to VEX specific equipment. (Carnegie Mellon): http://www.education.rec.ri.cmu.edu/roboticscurriculum/vex_online/lessons/remote_control/mult/cont_res.html
- The Physics Classroom, Waves: http://www.physicsclassroom.com/Class/waves/
- http://www.kettering.edu/~drussell/demos.html (acoustic and vibration animations)
- Transmitters.doc

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:
Have students fill out the Anticipation Guide for this chapter. Discuss their current knowledge with regard to transmitters / receivers and how they work.

Step 2:
Show PowerPoint presentation on Radio Control. Discuss pertinent vocabulary words and concepts. *(see Radio Control.ppt document)*

Step 3:
Show PowerPoint presentation on Resonance. Discuss pertinent vocabulary words and concepts. *(see Resonance.ppt document)*

Step 4:
Watch Tacoma Narrows Bridge video. Discuss relevance to this unit. *(see TacomaNarrows.asf document)*

Step 5:
Have students construct robots and perform the Teleoperation Experiments. *(see Teleoperation Experimentation.doc)*

Step 6:
Review for exam using class discussion, crossword puzzle, etc. *(see Chapt4_Crossword.doc.)*

Attachments for Learning Experiences:

Notes & Reflections:

Animation sequences in some PowerPoints do not work properly if viewed under Open Office or other presentation programs. Download the PowerPoint Viewer if your district does not possess PowerPoint.

Transmitter.doc is a document of many related facts, web links, charts, etc. that may be useful for further research, independent projects, to answer specific questions posed by students, or for personal edification. It is a resource, but not directly used with the students.

Students building multiple robots in a close proximity must beware of signal crossing. No two robots can have the same crystal set. This is the reason some manufactures are leaning towards using Bluetooth and other methods of communications to bypass the crystal proximity problem. You may have to test your links one or two at a time based on the number of available channels.

Building robots can take time. This lesson might be one to use in conjunction (after) you complete the robots for some other unit or purpose, thereby saving build time.

Chapter 4 Transmitters & Receivers Exam is available as an Exam Pro document (.tst), an RTF, and Zipped for inclusion in blackboard, angel, or CT Web (may or may not import).

CULMINATING PERFORMANCE TASK (Optional)

Culminating Unit Performance Task Title:

Teleoperation Experimentation.

Culminating Unit Performance Task Description/Directions/Differentiated Instruction:

Students will conduct experiments utilizing various antenna arrangements on their transmitters and receivers. Data will be collected and evaluated.

Attachments for Culminating Performance Task:

Teleoperation Experimentation worksheet *(see Teleoperation Experimentation. doc)*

UNIT RESOURCES

Web Resources:

US Frequency Allocations Chart:
http://www.ntia.doc.gov/osmhome/allochrt.pdf

Crystal Radio Demonstrations:
http://www.intuitor.com/resonance/cRadio.html

The Physics of Resonance:
http://www.intuitor.com/resonance/abcRes.html

Tesla, The Master of Resonance:
http://www.intuitor.com/resonance/tesla.php

How Radio Works:
http://electronics.howstuffworks.com/radio1.htm

How Does a CB Radio Antenna Work?
http://electronics.howstuffworks.com/question490.htm

How the Radio Spectrum Works:
http://www.howstuffworks.com/radio-spectrum.htm

Do certain radio wave frequencies (like those used by cell phones) pose health risks?
http://electronics.howstuffworks.com/question4.htm

Why do you hear some radio stations better at night than in the day?
http://electronics.howstuffworks.com/question1.htm

Could a wireless radio network save a miner's life?
http://electronics.howstuffworks.com/miner-wireless-radio-network.htm

What is low-power FM LPFM?
http://electronics.howstuffworks.com/question330.htm

Antenna Basics

http://www.electronics-tutorials.com/antennas/antenna-basics.htm

The Piezoelectric Effect (All about quartz crystals):
http://www.favonius.com/soaring/crystals/crystals.htm

Tacoma narrows bridge oscillation and resonance
Wikipedia:
http://en.wikipedia.org/wiki/Tacoma_Narrows_Bridge
http://videos.howstuffworks.com/tlc/29833-understanding-tacoma-narrows-bridge-video.htm
www.youtube.com/watch?v=HxTZ446tbzE
http://www.encyclomedia.com/video-tacoma_suspension_bridge_disaster.html
http://encarta.msn.com/media_461550807/collapse_of_the_tacoma_narrows_bridge.html

PDF on Tacoma Narrows Disaster:
http://shippai.jst.go.jp/en/Detail?fn=2&id=CA1000632

PDF How to Simulate the TCN Oscillations:
http://www.physics.ohio-state.edu/~kagan/phy596/Articles/TacomaNarrowsBridge/PhysicsTeacher-SimulationofTacomaNarrows.pdf

Washington State Tocoma Narrows Bridge Lesson Plans (extensive site):
http://www.wsdot.wa.gov/TNBhistory/
http://www.ketchum.org/bridgecollapse.html
http://www.lib.washington.edu/specialcoll/exhibits/tnb/
http://content.lib.washington.edu/farquharsonweb/index.html
http://www.civeng.carleton.ca/Exhibits/Tacoma_Narrows/DSmith/photos.html
http://www.stkate.edu/physics/phys111/curric/tacomabr.html

Attachment(s):

Materials & Equipment:

What 21st Century Technology was used in this unit?

x	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	x	Wiki		Electronic Game or Puzzle Maker
	Email	x	Website		