FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

OFFICE OF CURRICULUM AND INSTRUCTION

TECHNOLOGY EDUCATION DEPARTMENT

HONORS ELECTRONICS 2

Grade Level: 10-12

Credits: 5

BOARD OF EDUCATION ADOPTION DATE:

AUGUST 22, 2011

FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

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Honors Electronics II - Introduction

Introduction

Course Philosophy

Our present society is dependent upon the application of electronics and it has become an essential component of our nations' economic growth. A technologically literate citizen will draw upon their knowledge and skills in electronics concepts to solve real world problems. Electronic applications connect math, science and language arts skills in the real world. This course provides an overview of electronics as a continual and expanding field with relation to its importance and impact on today's society.

This advanced course of study will provide the student opportunity to explore advanced electronic theory, principles, and applications. Differentiated instruction within the course will include such activities as experiments, problem solving activities, individual and cooperative based student projects, and computer aided instruction. Students will relate the applications of electronics technology to the planning and completion of personal, social and career goals. Students will also demonstrate proper safety procedures as they develop skills in using technological equipment, materials and processes.

This course will support the student's interest and aptitude in electronics. Career and job opportunities will be explored to assist students in deciding their career paths.

Course Description

Electronics II is a 5 credit elective course open to all students in grades 10-12. A prerequisite is the successful completion of Electronics I or departmental recommendation.

Electronics II is designed for the student who has mastered a fundamental knowledge of basic electricity/electronics and desires to further his/her appreciation, knowledge and understanding of becoming technologically literate.

The course will include an investigation of the basic electronic concepts of inductance, capacitance, reactance, impedance and resonance. The operation of semiconductor devices will be included. The basic concepts and components common to electronics will be used to explore the function and operation of the three basic electronic circuits – the power supply, amplifier, and oscillator. Included will be the function and operation of electronic test equipment such as oscilloscope, digital meters, signal generator, and frequency counter. Printed circuit techniques, tool/machine operation, soldering, material fabrication and computer assisted software are all included in this course.

Course Map and Proficiencies/Pacing

Course Map

Relevant Standards	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic	**Formative**	**Summative**
8.2.F.1 9.1.F.2 9.1.F.3 9.1.F.4 9.1.F.5	The proper implementation of personal protective equipment, the understanding of machine/tool safety and instruction regarding correct shop procedure is crucial in an electronics laboratory	What are the safety concerns to be considered when working in a lab setting in school or on the job? What protection can be used in laboratory environment?	Do Now Pre-test Student survey Oral questions/ discussion Anticipatory set questions	Journals Quizzes Written assignments Oral presentations Observations Participatory rubrics Research assignments	Portfolios Project-based learning rubric assessment Self and peer assessment Performance assessment Open notebook tests Midterm/final examination
8.2.A.1-3 8.2.B.1-3 8.2.C.2-3	Design plays an important role in the creation of electrical based products and prototype	What are the major steps of the design process? How does the design process produce more successful technologies? What are some methods used to share design ideas? What is the difference between a model and a prototype? How do computers evaluate and test a prototype?	Do Now Pre-test Student survey Oral questions/ discussion Anticipatory set questions	Journals Quizzes Written assignments Oral presentations Observations Participatory rubrics Research assignments	Portfolios Project-based learning rubric Assessment Self and peer assessment Performance assessment Midterm/final examination

8.2.A.1 8.2.B.1 8.2.F.1	Circuit design is made of three primary stages: prototyping, testing and final production	What are the prototyping platforms are used to design of circuits? How are electrical circuits tested to insure proper operation? How is a schematic diagram converted to a printed circuit layout? How are printed circuit boards made?	Do Now Pre-test Student survey Oral questions/ discussion Anticipatory set questions	Journals Quizzes Written assignments Oral presentations Observations Participatory rubrics Research assignments	Portfolios Project-based learning rubric assessment Self and peer assessment Performance assessment Open notebook tests Midterm/final examination
4.5.F.1 4.5.F.6 5.7.A.5 8.2.A.1 8.2.B.6 8.2.C.3	Amplification, Modulation and Rectification represent the basic processes needed for electronic communication	How are Amplification, Modulation and Rectification used in communications? How are Amplification, Modulation and Rectification created, measured and controlled?	Do Now Pre-test Student survey Oral questions/ discussion Anticipatory set questions	Journals Quizzes Written assignments Oral presentations Observations Participatory rubrics Research assignments	Portfolios Project-based learning rubric assessment Self and peer Assessment Performance assessment Open notebook tests Midterm/final examination

6.1.A.1 6.2.E.9 6.6.E.8 8.2.C.3	Modern electrical devices utilize analog and digital components along with digital logic in their overall operation	How can a digital component be identified? How do digital components communicate? Why is a digital circuit better than an analog circuit? What are the differences between intelligence and logic?	Do Now Pre-test Student survey Oral questions/ discussion Anticipatory set questions	Journals Quizzes Written assignments Oral presentations Observations Participatory rubrics Research assignments	Portfolios Project-based learning rubric assessment Self and peer assessment Performance assessment Open notebook tests Midterm/final examination
4.5.12 C.4 4.5.12 C.3 5.1.12.A.3	Digital logic gates process signals which represent the basis for digital electronics	What are the various types of digital logic gates? How do digital logic gates function and process data?	Do Now Pre-test Student survey Oral questions/ discussion Anticipatory Set Questions	Journals Quizzes Written assignments Oral presentations Observations Participatory Rubrics Research Assignments	Portfolios Project-based learning rubric assessment Self and peer assessment Performance assessment Open notebook tests Midterm/Final examination

4.5.12 C.4 4.5.12 C.3 5.1.12.A.3 8.2.12C.2 8.2.12 C.3	Analog/digital sensor technology is essential in developing systems control	What are the six families of electrical sensors? What are the functions of digital and analog sensors? How do sensors convert and input information from a given stimuli/environment?	Do Now Pre-test Student survey Oral questions/ discussion Anticipatory set questions	Journals Quizzes Written assignments Oral presentations Observations Participatory rubrics Research assignments	Portfolios Projects-based Learning Rubric Assessment Self and peer assessment Performance assessment Open notebook tests Midterm/final examination
4.5.12 C.4 4.5.12 C.3 5.1.12.A.3 8.2.12C.2 8.2.12 C.3	Advanced Digital Robotics is the basis for the design and development of Intelligent Automation as used by current and future industry	What types of programming language are used in Advanced Digital Robotics? How do micro controllers, along with other mechanical components, perform advanced robotic tasks?	Do Now Pre-test Student survey Oral questions/ discussion Anticipatory set questions	Journals Quizzes Written assignments Oral presentations Observations Participatory rubrics Research assignments	Portfolios Projects-based learning rubric assessment Self and peer assessment Performance assessment Open notebook tests Midterm/final examination

9.1.12 A.2 9.1.12 A.3	Career Education provides the knowledge, skill and attitude essential to meet a lifetime of career challenges in a competitive global society by recognizing and drawing upon the strengths and interest of each student	What can a student do to maximize their prospective employment potential? What areas provide the best opportunity for prospective employment?	Do Now Pre-test Student survey Oral questions/ discussion Anticipatory set questions	Journals Quizzes Written assignments Oral presentations Observations Participatory rubrics Research assignments	Portfolios Projects-based learning rubric assessment Self and peer assessment Performance assessment Open notebook tests Midterm/final examination

TEC.9-12.8.1.12 B.9 Create and manipulate information, independently and/or collaboratively, to solve problems and design and develop products.

Proficiencies and Pacing

Unit Title	Unit Understanding(s) and Goal(s)	Recommended Duration
Unit 1: Lab, Equipment and Procedural Safety	**Enduring Understandings:** The proper implementation of personal protective equipment, the understanding of machine/tool safety and instruction regarding correct shop procedure is crucial in an electronics laboratory. **Essential Questions:** What are the safety concerns to be considered when working in a lab setting in school or on the job? What protection can be used in a laboratory environment? **Unit Goals:** Students will be able to identify and implement proper safety in a work environment. Students will understand the importance of collaboration and effective teamwork skills. Students will be able to utilize technological tools and equipment safely to create products and systems.	4 weeks
Unit 2: Electrical Engineering Design and Configuration	**Enduring Understandings:** Design plays an important role in the creation of electrical based products and prototypes. **Essential Questions:** What are the major steps of the design process? How does the design process produce more successful technologies? What are some methods used to share design ideas? What is the difference between a model and a prototype? How do computers evaluate and test a prototype? **Unit Goals:** Students will be able to describe and implement the design loops steps in an electronics application. Students will be able to create sound technology solutions which are appropriate for the problems they solve. Students will be able to evaluate and critique their work and their peer's work.	6 weeks
Unit 3: Circuit Prototyping and Testing	**Enduring Understandings:** Circuit design is made of three primary stages: prototyping, testing and final production. **Essential Questions:** What are the prototyping platforms are used to design of circuits? How are electrical circuits tested to insure proper operation? How is a schematic diagram converted to a printed circuit layout? How are printed circuit boards made? **Unit Goals:** Students will be able to design and construct working circuits on a variety of platforms. Students will be able to troubleshoot non-functioning circuits. Students will be able to convert schematic diagrams into printed circuit layouts. Students will be able to manufacture their own printed circuits boards.	5 weeks

Unit 4: Amplification, Modulation and Rectification	**Enduring Understandings:** Amplification, Modulation and Rectification represent the basic processes needed for electronic communication. **Essential Questions:** How are Amplification, Modulation and Rectification used in communications? How are Amplification, Modulation and Rectification created, measured and controlled? **Unit Goals:** Students will be able to design and building a working amplifier using a provided schematic. Students will be able to modulate an electrical signal using a circuit they built. Students will be able to design and construct a working AC/DC converter using rectification.	4 weeks
Unit 5: Analog and Digital Circuitry	**Enduring Understandings:** Modern electrical devices utilize analog and digital components along with digital logic in their overall operation. **Essential Questions:** What are the hexadecimal and digital logic number systems and what is there relationship to digital electronics? What is Boolean logic and what is its relationship to digital electronics? What components are used in analog and digital circuitry? How can logic circuits be programmed and where are these types of circuits used? **Unit Goals:** Students will be able to use the hexadecimal and binary number system to do digital logic calculations. Students will be able to identify different types of electrical components used in analog and digital circuitry. Students will be able to construct analog and digital circuits.	6 weeks

Unit 6: Digital Logic Gates	**Enduring Understandings:** Digital logic gates process signals which represent the basis for digital electronics. **Essential Questions:** What are the different types of logic gates and how do they function? How can logic circuits be programmed and where are these types of circuits used? **Unit Goals:** Students will be able to identify the different types of logic gates and describe their function. Students will understand how a logic gate will be affected by an Analog or Digital signal. Students will be able to construct circuits using different types of logic gates and do so to obtain a desired result.	4 weeks
Unit 7: Analog/Digital Sensor Technology	**Enduring Understandings:** Analog/digital sensor technology is essential in developing systems control. **Essential Questions** What are analog and digital sensors and how do they function? How are analog and digital sensors used in automation? How can analog and digital circuitry be used in conjunction with analog and digital sensors? **Unit Goals:** Students will be able to identify basic analog and digital sensors and explain their function. Students will understand how analog and digital sensors can be used in conjunction with analog and digital circuitry to achieve a desired output. Students will be able to construct circuitry that will utilize analog and digital sensors.	4 weeks
Unit 8: Advanced Digital Robotics	**Enduring Understandings:** Advanced digital robotics is the basis for the design and development of intelligent automation as used by current and future industry. **Essential Questions:** How can logic circuits be programmed and where are these types of circuits used? How does Robotics technology use programmable chips and circuits? How does advanced robotics programming work? **Unit Goals:** Students will understand basic digital logic commands and how they work in programming. Students will be able to use digital electronics, robotics technology and programming to create programmable robot. Students will understand how robotics technology uses programmable chips and circuits and be able to use this technology to build and program an autonomous robotic project.	6 weeks

Unit 9: Careers in Electronics	**Enduring Understandings:** Career education provides the knowledge, skill and attitude essential to meet a lifetime of career challenges in a competitive global society by recognizing and drawing upon the strengths and interest of each student. **Essential Questions:** What are examples of the employment/career opportunities open to the field of advanced electronics? What types of training/certification are needed for a career in advanced electronics? Where can training for a career in advanced electronics be obtained? **Unit Goals:** Students will be able to identify various kinds of employment/career opportunities open to the field of advanced electronics. Students will be able to identify and explain what kinds of certifications are needed for employment in the field of advanced electronics. Students will be able to identify and explain where training for certification in the field of advanced electronics can be obtained.	1 week

Honors Electronics II - Unit 1

Lab, Equipment & Procedural Safety

Enduring Understandings:

The proper implementation of personal protective equipment, the understanding of machine/tool safety and instruction regarding correct shop procedure is crucial in an electronics laboratory.

Essential Questions:

What are the safety concerns to be considered when working in a lab setting in school or on the job?

What protection can be used in a laboratory environment?

Unit Goals:

Students will be able to identify and implement proper safety in a work environment.

Students will understand the importance of collaboration and effective teamwork skills.

Students will be able to utilize technological tools and equipment safely to create products and systems.

Recommended Duration: 4 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
Why should safety be the first concern while working in a technology laboratory? How do we protect ourselves around dangerous equipment, tools and chemicals?	Understand and be able to follow the required safety rules for the equipment and tools in the laboratory	Lab safety rules (will change based upon resources utilized): Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Optional textbooks: *Engineering Design: An Introduction* *Design and Problem Solving in Technology* Example online resources: Safety rules and regulations Example worksheets: Safety and regulations	Overview of all classroom equipment and safety guidelines Define PPE (personal protective equipment) and list the various forms it comes in Explain the role of OSHA *(Occupation Safety and Hazard Administration)* in the development of new safety guidelines Students will complete safety worksheets individually using unit content Students will design safety posters based on one of the machines they were tested on Complete practical activities for all equipment as demonstration of proper operation	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Practical assessments for all equipment Self and peer assessments TSA rubrics Midterm/final examination

WORK.9-12.9.2.12 F.2	Describe and demonstrate basic first aid and safety procedures.
WORK.9-12.9.2.12 F.3	Analyze the occurrence of workplace hazards.
WORK.9-12.9.2.12 F.4	Practice the safe use of tools and equipment.
WORK.9-12.9.2.12 F.5	Implement safety procedures in the classroom and workplace, where appropriate.
TEC.9-12.8.1.12.F.1	Select and use specialized databases for advanced research to solve real-world problems.

Differentiation

A hands-on approach to assignments and projects is recommended as the most effective method of learning. Teacher should always adjust learning environment based on reluctant learners or special education needs.
Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods

A wide variety of assessments and strategies complement the individual learning experience.

Technology

Multiple forms of technology will be used throughout this unit to teach the students effectively and to engage learners who might have trouble with more traditional instructional methods.

These methods include but are not limited to: web quests, video/audio clips, flash animations and instructional web tutorials.

College and Workplace Readiness

The Electronics program is designed to give students interested in engineering or technology based occupation, the skills and knowledge necessary to work within an electronics environment. The majority of the content can easily translate to a first year college level electronics course and might even count towards college credit at select schools and trade programs.

Honors Electronics II - Unit 2

Electrical Engineering Design & Configuration

Enduring Understandings:

Design plays an important role in the creation of electrical based products and prototypes.

Essential Questions:

What are the major steps of the design process?

How does the design process produce more successful technologies?

What are some methods used to share design ideas?

What is the difference between a model and a prototype?

How do computers evaluate and test a prototype?

Unit Goals:

Students will be able to describe and implement the design loops steps in an electronics application.

Students will be able to create sound technology solutions which are appropriate for the problems they solve.

Students will be able to evaluate and critique their work and their peer's work.

Recommended Duration: 6 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
How does brainstorming help to open up new ideas for products and future technologies? Why is it important to properly research a topic before developing a solution? What are some methods if illustrating your design ideas?	Understand and be able to explain the different steps of the design process: *Investigation and Research, Brainstorming, Create Solutions, Choose the Best Solution, Develop the Chosen Solution, Testing and Evaluation and Redesign*	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Optional textbooks: *Engineering Design: An Introduction* *Design and Problem Solving in Technology* Example online resources: Design loop	Design loop drawing Utilize mapping and webs to brainstorm new designs Problem solving challenges	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Self and peer assessments TSA rubrics Midterm/final examination
Why can taking apart an existing technology help us to better understand how it works and what thinking was used in its design? What are some methods which can be used to evaluate the efficiency of a solution?	Explain the importance of “reverse engineering” and how it plays a role in the design process	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Optional textbooks: *Engineering Design: An Introduction* *Design and Problem Solving in Technology* Example video clips: Real worlds examples: NASA “spin-off” technology Individuals/guest speakers from industry	Video clip of reverse engineering techniques and examples Identify products that were created as “spin-offs” from another design Students will complete “Reverse Engineering Worksheets” using unit content Student online research of “spin-offs”	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Self and peer assessments TSA rubrics Midterm/final examination

TEC.9-12.8.1.12.A.3	Participate in online courses, learning communities, social networks, or virtual worlds and recognize them as resources for lifelong learning.
TEC.9-12.8.2.12.B.1	Design and create a product that maximizes conservation and sustainability of a scarce resource, using the design process and entrepreneurial skills throughout the design process.
TEC.9-12.8.2.12.B.2	Design and create a prototype for solving a global problem, documenting how the proposed design features affect the feasibility of the prototype through the use of engineering, drawing, and other technical methods of illustration.
TEC.9-12.8.2.12.B.3	Analyze the full costs, benefits, trade-offs, and risks related to the use of technologies in a potential career path.
TEC.9-12.8.2.12.C.1	Analyze the ethical impact of a product, system, or environment, worldwide, and report findings in a web-based publication that elicits further comment and analysis.
TEC.9-12.8.2.12.C.2	Evaluate ethical considerations regarding the sustainability of resources that are used for the design, creation, and maintenance of a chosen product.
TEC.9-12.8.2.12.C.3	Evaluate the positive and negative impacts in a design by providing a digital overview of a chosen product and suggest potential modifications to address the negative impacts.

Differentiation

A hands-on approach to assignments and projects is recommended as the most effective method of learning. Teacher should always adjust learning environment based on reluctant learners or special education needs.
Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods.

A wide variety of assessments and strategies complement the individual learning experience.

Technology

Multiple forms of technology will be used throughout this unit to teach the students effectively and to engage learners who might have trouble with more traditional instructional methods.

These methods include but are not limited to: web quests, video/audio clips, flash animations and instructional web tutorials.

College and Workplace Readiness

The Electronics program is designed to give students interested in engineering or technology based occupation, the skills and knowledge necessary to work within an electronics environment. The majority of the content can easily translate to a first year college level electronics course and might even count towards college credit at select schools and trade programs.

Honors Electronics II - Unit 3

Circuit Prototyping and Testing

Enduring Understandings:

Circuit design is made of three primary stages: prototyping, testing and final production.

Essential Questions:

What are the prototyping platforms are used to design of circuits?

How are electrical circuits tested to insure proper operation?

How is a schematic diagram converted to a printed circuit layout?

How are printed circuit boards made?

Unit Goals:

Students will be able to design and construct working circuits on a variety of platforms.

Students will be able to troubleshoot non-functioning circuits.

Students will be able to convert schematic diagrams into printed circuit layouts.

Students will be able to manufacture their own printed circuits boards.

Recommended Duration: 5 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
What is a "breadboard" and how is it used?	Understand and be able to construct circuits on a "breadboard" platform Diagnose and repair malfunctioning circuits built on a "breadboard"	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Online resource	Overview of the "breadboard's" layout and explanation of its uses for experimentation Basic circuit building using a "breadboard" Worksheets relating to the "breadboard" focusing on the layout of the board and how to wire circuits properly	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm /final examination
What are the major differences between a schematic design and a printed circuit design?	Converting schematics to printed circuit layouts Properly designing printed circuit layouts for spacing and size of components Using CAD software to assist in the designing of printed circuit layouts	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Optional software Online resources	Compare and contrast the pros's and con's of schematics and printed circuit layouts Explain the conversions from a schematic to a PCB layout Allow the students to convert circuits which were built using schematics into PCB's either by hand or using CAD software Show the students some PCB's which can been seen in everyday products and discuss their effectiveness compared to "breadboard" platforms	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination

What is the procedure needed to manufacture a printed circuit board?	Safely etch a circuit board using common etch-ant solution and copper clad circuit board Explain the steps needed to manufacture a working circuit board Properly assemble and solder a working circuit board designed by the student	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Optional software Online resources	Explain the safety concerns while etching a circuit board and go over the steps to avoid injury Have the students pass a safety quiz on the discussed content to 100% before allowing them to use the etching tank Discuss the manufacturing steps needed to create a working circuit board Have each student create a circuit board of their design either by hand or using CAD software	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups safety quizzes Self and peer assessments Midterm /final examination

TEC.9-12.8.2.12.A.1 Design and create a technology product or system that improves the quality of life and identify trade-offs, risks, and benefits.
TEC.9-12.8.2.12.B.1 Design and create a product that maximizes conservation and sustainability of a scarce resource, using the design process and entrepreneurial skills throughout the design process.
TEC.9-12.8.2.12.F.1 Determine and use the appropriate application of resources in the design, development, and creation of a technological product or system.

Differentiation

A hands-on approach to assignments and projects is recommended as the most effective method of learning. Teacher should always adjust learning environment based on reluctant learners or special education needs.
Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods

A wide variety of assessments and strategies complement the individual learning experience.

Technology

Multiple forms of technology will be used throughout this unit to teach the students effectively and to engage learners who might have trouble with more traditional instructional methods.

These methods include but are not limited to: web quests, video/audio clips, flash animations and instructional web tutorials.

College and Workplace Readiness

The Electronics program is designed to give students interested in engineering or technology based occupation, the skills and knowledge necessary to work within an electronics environment. The majority of the content can easily translate to a first year college level electronics course and might even count towards college credit at select schools and trade programs.

Honors Electronics II - Unit 4

Amplification, Modulation and Rectification

Enduring Understandings:

Amplification, Modulation and Rectification represent the basic processes needed for electronic communication.

Essential Questions:

How are Amplification, Modulation and Rectification used in communications?

How are Amplification, Modulation and Rectification created, measured and controlled?

Unit Goals:

Students will be able to design and building a working amplifier using a provided schematic.

Students will be able to modulate an electrical signal using a circuit they built.

Students will be able to design and construct a working AC/DC converter using rectification.

Recommended Duration: 4 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
How is an electrical signal amplified? What is the difference between a non-inverting and an inverting amplifier? What are some products which utilize amplifiers in their operation?	Design and construct a working amplifier using a transformer. Design and construct a working amplifier using integrated circuits (ex: 741 Op Amp) Identify products which use amplifiers in their operation and be able to explain what type of amplifier each is	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet	Introduction to amplification through various examples and products Overview of what components are needed to build an amplifier Discussion of inverting vs. non-inverting amplifier Construction of student designed audio amplifiers	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination
Why must radio and communication signals be modulated? What is the difference between AM (amplitude modulation) and FM (frequency modulation)? What are some circuits and/or components which can be used to modulate an electrical signal?	Change an electrical signal from an analog waveform to a digital waveform using modulation Create a circuit which can either transmit or receive data across a specified radio frequency Properly measure the frequency of an electrical signal using an oscilloscope	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Online resource	Discussion regarding frequency of electrical signals and how they are measured Overview of the different types of radio signals and waveforms Worksheet regarding AM and FM and the pro's and con's of each Lab activity involving the construction of a pulse width modulator and a frequency modulator using a LM555 timer	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination

How do we convert AC (alternating current) into DC (direct current)? What role does a diode play in the rectification of a signal? What instruments can be used to test the effectiveness of a rectification circuit?	Explain the design and operation of a "Bridge Rectifier" and be able to lists it's major components Successfully design and AC to DC converter using a rectification circuit Test the effectiveness of each converter built using an oscilloscope and a multi-meter	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Online resources	Lesson on different types of diodes and their construction (P-N Junctions) demonstration of alternating current and direct current using an oscilloscope Overview of a "Bridge Rectifier" and discussion of the major components Construction of a properly designed AC to DC converter using a provided schematic Lab activities to test the effectiveness of each converter using a variety of diagnostic equipment	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination

SCI.9-12.5.7.12 A.5	Know that there are strong forces that hold the nucleus of an atom together and that significant amounts of energy can be released in nuclear reactions (fission, fusion, and nuclear decay) when these binding forces are disrupted.
MA.12.4.5 F.1	Use technology to gather, analyze, and communicate mathematical information.
MA.12.4.5 F.6	Use computer-based laboratory technology for mathematical applications in the sciences (cf. science standards).
TEC.9-12.8.2.12.B	Design: Critical Thinking, Problem Solving, and Decision-Making
TEC.9-12.8.2.12.A.1	Design and create a technology product or system that improves the quality of life and identify trade-offs, risks, and benefits.
TEC.9-12.8.2.12.C.3	Evaluate the positive and negative impacts in a design by providing a digital overview of a chosen product and suggest potential modifications to address the negative impacts.

Differentiation

A hands-on approach to assignments and projects is recommended as the most effective method of learning. Teacher should always adjust learning environment based on reluctant learners or special education needs.
Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods

A wide variety of assessments and strategies complement the individual learning experience.

Technology

Multiple forms of technology will be used throughout this unit to teach the students effectively and to engage learners who might have trouble with more trouble with more traditional instructional methods.

These methods include but are not limited to: web quests, video/audio clips, flash animations and instructional web tutorials.

College and Workplace Readiness

The Electronics program is designed to give students interested in engineering or technology based occupation, the skills and knowledge necessary to work within an electronics environment. The majority of the content can easily translate to a first year college level electronics course and might even count towards college credit at select schools and trade programs.

Honors Electronics II - Unit 5

Analog and Digital Circuitry

Enduring Understandings:

Modern electrical devices utilize analog and digital components along with digital logic in their overall operation.

Essential Questions:

What are the hexadecimal and digital logic number systems and what is there relationship to digital electronics?

What is Boolean Logic and what is its relationship to digital electronics?

What components are used in analog and digital circuitry?

How can logic circuits be programmed and where are these types of circuits used?

Unit Goals:

Students will be able to use the hexadecimal and binary number system to do digital logic calculations.

Students will be able to identify different types of electrical components used in analog and digital circuitry.

Students will be able to construct analog and digital circuits.

Recommended Duration: 4 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
What do the terms analog and digital mean and how do they differ?	Students will understand and be able to explain what analog and digital means	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic simulator Circuit simulator Online resources	Lecture & demonstration on analog & digital circuitry Multimedia presentation Dialogue & discussion Video presentation Lab	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination
What are some common every day items that operate on the principals of analog and digital?	Students will be able to give examples analog and digital operation Students will understand and be able to compare analog and digital circuitry to the operation of every day items that function in an analog or digital way	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic simulator Circuit simulator Online resources	Lecture & demonstration on analog & digital circuitry Multimedia presentation Dialogue & discussion Video presentation Lab	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination

What are the numbering systems that are most prominent in the world analog and digital electronics?	Students will understand and be able to use the hexadecimal and binary number systems to do simple digital calculations	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic simulator Circuit simulator Online resources	Lecture & demonstration on analog & digital circuitry Multimedia presentation Dialogue & discussion Video presentation Lab	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination
How are analog and digital components used in circuitry?	Students will be able to identify and define the purpose of several electrical components that are used in analog and digital circuitry Students will be able to construct simple circuitry that utilizes analog and digital components	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic Simulator Circuit Simulator Online resources	Lecture & demonstration on analog & digital circuitry Multimedia presentation Dialogue & discussion Video presentation Lab	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination

SOC.9-12.6.1.12 A.1	Analyze how historical events shape the modern world.
SOC.9-12.6.2.12 E.9	Discuss the impact of technology, migration, the economy, politics, and urbanization on culture.
SOC.9-12.6.6.12 E.8	Delineate and evaluate the environmental impact of technological change in human history (e.g., printing press, electricity and electronics, automobiles, computer, and medical technology).
TEC.9-12.8.2.12.C.3	Evaluate the positive and negative impacts in a design by providing a digital overview of a chosen product and suggest potential modifications to address the negative impacts.

Differentiation

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Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods

A wide variety of assessments and strategies complement the individual learning experience.

Technology

Multiple forms of technology will be used throughout this unit to teach the students effectively and to engage learners who might have trouble with more traditional instructional methods. These methods include but are not limited to: web quests, video/audio clips, flash animations and instructional web tutorials.

College and Workplace Readiness

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Honors Electronics II - Unit 6

Digital Logic Gates

Enduring Understandings:

Digital Logic Gates process signals which represent the basis for Digital Electronics.

Essential Questions:

What are the different types of logic gates and how do they function?

How can logic circuits be programmed and where are these types of circuits used?

Unit Goals:

Students will be able to identify the different types of logic gates and describe their function.

Students will understand how a logic gate will be affected by an Analog or Digital signal.

Students will be able to construct circuits using different types of logic gates and do so to obtain a desired result.

Recommended Duration: 4 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
What is a digital logic gate?	Students will understand and be able to explain the function of a digital logic gate	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic simulator Circuit simulator Online resources	Lecture & demonstration on types of digital logic gates Multimedia presentations Dialogue & discussion Video presentation Lab	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination
What are the different kinds of digital logic gates?	Students will understand and be able to identify the different types of digital logic gates	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic simulator Circuit simulator Online resources	Lecture & Demonstration on the types of digital logic gates Multimedia presentation Dialogue & discussion Video presentation Lab	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination

What functions do logic gates perform?	Students will understand and be able to explain the functions of the various digital logic gates Students will understand and be able to apply the functions of the various digital logic gates by using them in a digital logic simulator	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic simulator Circuit simulator Online resources	Lecture & Demonstration on Digital Logic gate functions Multimedia presentation Dialogue & discussion Video presentation Logic gate simulator program Lab Logic gate projects	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination
How is a logic gate combined to create digital logic circuitry?	Students will understand and be able to explain how digital logic circuitry is created by combining different digital logic gates Students will understand and be able to create digital logic circuitry by combining digital logic gates using a digital logic simulator	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic simulator Circuit simulator Online resources	Lecture & demonstration on digital Logic gate circuitry Multimedia presentation Dialogue & discussion Video presentation Logic gate simulator program Lab Logic gate projects	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and Peer assessments Midterm/final examination

SCI.9-12.5.1.12 A.3	Engage in collaboration, peer review, and accurate reporting of findings.
MA.12.4.5 C.3	Recognize that mathematics is used in a variety of contexts outside of mathematics.
MA.12.4.5 C.4	Apply mathematics in practical situations and in other disciplines.

Differentiation

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Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods

A wide variety of assessments and strategies complement the individual learning experience.

Technology

Multiple forms of technology will be used throughout this unit to teach the students effectively and to engage learners who might have trouble with more traditional instructional methods. These methods include but are not limited to: web quests, video/audio clips, flash animations and instructional web tutorials.

College and Workplace Readiness

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Honors Electronics II - Unit 7

Analog/Digital Sensor Technology

Enduring Understandings:

Analog/digital sensor technology is essential in developing systems control.

Essential Questions

What are analog and digital sensors and how do they function?

How are analog and digital sensors used in automation?

How can analog and digital circuitry be used in conjunction with analog and digital sensors?

Unit Goals:

Students will be able to identify basic analog and digital sensors and explain their function.

Students will understand how analog and digital sensors can be used in conjunction with analog and digital circuitry to achieve a desired output.

Students will be able to construct circuitry that will utilize analog and digital sensors.

Recommended Duration: 4 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
What are some examples of analog and digital sensors?	Students will understand and be able to explain what an analog and digital sensor is Students will understand and be able to identify various types of analog and digital sensors	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic simulator Circuit simulator Online resources	What kinds of activities might the teacher facilitate with the students, using the resources, to explore the content/themes/skills?	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination
What is the difference between an analog and digital sensor?	Students will understand and be able to explain the operation of digital and analog sensors Students will understand and be able to give examples of where digital and analog sensors are use and how their applications will differ	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic simulator Circuit simulator Online resources		Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination

How can analog and digital sensors be controlled?	Students will understand and be able to explain programming language that can be used to control analog and digital sensors Students will understand and be able to demonstrate how analog and digital sensors can be controlled by building and programming a platform that will use digital and analog sensors	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic simulator Circuit simulator Online resources		Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination
How are analog and digital sensors used in conjunction with industrial automation?	Students will understand and be able to explain various applications of analog and digital sensors as relating to industrial automation	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic simulator Circuit simulator Online resources		Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination

What kind of circuitry is used in analog and digital sensor technology?	Students will understand and be able to explain various types of circuitry that utilize the application of digital and analog sensors Students will understand and be able to demonstrate how circuitry is used in analog and digital sensor technology by constructing and testing these kinds of circuits	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic simulator Circuit simulator Online resources		Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination

SCI.9-12.5.1.12 A.3	Engage in collaboration, peer review, and accurate reporting of findings.
MA.12.4.5 C.3	Recognize that mathematics is used in a variety of contexts outside of mathematics.
MA.12.4.5 C.4	Apply mathematics in practical situations and in other disciplines.
TEC.9-12.8.2.12.C.2	Evaluate ethical considerations regarding the sustainability of resources that are used for the design, creation, and maintenance of a chosen product.
TEC.9-12.8.2.12.C.3	Evaluate the positive and negative impacts in a design by providing a digital overview of a chosen product and suggest potential modifications to address the negative impacts.

Differentiation

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Technology

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College and Workplace Readiness

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Honors Electronics II - Unit 8

Advanced Digital Robotics

Enduring Understandings:

Advanced Digital Robotics is the basis for the design and development of Intelligent Automation as used by current and future industry.

Essential Questions:

How can logic circuits be programmed and where are these types of circuits used?

How does robotics technology use programmable chips and circuits?

How does advanced Robotics programming work?

Unit Goals:

Students will understand basic digital logic commands and how they work in programming.

Students will be able to use digital electronics, Robotics technology and programming to create programmable robot.

Students will understand how Robotics technology uses programmable chips and circuits and be able to use this technology to build and program an autonomous robotic project.

Recommended Duration: 4 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
What is advanced digital robotics?	Students will be able to explain what advanced digital robotics is Students will be able to give examples of advanced digital robotics What is the difference between an autonomous and non autonomous robot	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic simulator Circuit simulator Online resources	Lecture & Demonstration on advanced digital robotics Multimedia presentation Dialogue & discussion Video presentation Logic gate simulator program Logic programming Lab	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Thread discussion groups Safety quizzes Self and peer assessments Midterm/final examination
What is programmable robotics?	Students will understand and be able to explain what a programmable robot is Students will be able to give examples of program types and language used to command robots How can programmable robotics be utilized by industry Students will be able to build and program a robot to perform specific tasks	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic simulator Circuit simulator Online resources	Lecture & Demonstration on programmable robotics Multimedia presentation Dialogue & discussion Video presentation Logic gate simulator program Logic programming Lab Programmable robotics project	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination

How is advanced digital robotics beneficial to industrial automation?	Students will be able to give examples of various industries that utilize programmable robots Students will be able to explain how advanced digital robotics can aid and streamline the industrial process	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic simulator Circuit simulator Online resources	Lecture & Demonstration on programmable robotics & industrial automation Multimedia presentation Dialogue & discussion Video presentation Logic gate simulator program Logic programming Lab Programmable robotics project	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion Questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination
How is digital logic utilized in the area of advance digital robotics?	Students will be able to explain the function of digital logic as it relates to advanced robotics Students will be able to demonstrate how digital logic can be used to program a robot	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic simulator Circuit simulator Online resources	Lecture & Demonstration on programmable robotics Multimedia presentation Dialogue & discussion Video presentation Logic gate simulator program Logic programming Lab Programmable robotics project	Written tests and quizzes Worksheets Project assessments Article summaries Notebook assessments Responses to discussion questions Journal assessments Threaded discussion groups Safety quizzes Self and peer assessments Midterm/final examination

SCI.9-12.5.1.12 A.3	Engage in collaboration, peer review, and accurate reporting of findings.
MA.12.4.5 C.3	Recognize that mathematics is used in a variety of contexts outside of mathematics.
MA.12.4.5 C.4	Apply mathematics in practical situations and in other disciplines.
TEC.9-12.8.2.12.C.2	Evaluate ethical considerations regarding the sustainability of resources that are used for the design, creation, and maintenance of a chosen product.
TEC.9-12.8.2.12.C.3	Evaluate the positive and negative impacts in a design by providing a digital overview of a chosen product and suggest potential modifications to address the negative impacts.

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Technology

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College and Workplace Readiness

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Honors Electronics II - Unit 9

Careers in Electronics

Enduring Understandings:

Career Education provides the knowledge, skill and attitude essential to meet a lifetime of career challenges in a competitive global society by recognizing and drawing upon the strengths and interest of each student.

Essential Questions:

What are examples of the employment/career opportunities open to the field of advanced electronics?

What types of training/certifications are needed for a career in advanced electronics?

Where can training for a career in advanced electronics be obtained?

Unit Goals:

Students will be able to identify various kinds of employment/career opportunities open to the field of advanced electronics.

Students will be able to identify and explain what kinds of certifications are needed for employment in the field of advanced electronics.

Students will be able to identify and explain where training for certification in the field of advanced electronics can be obtained.

Recommended Duration: 2 weeks

Guiding/Topical Questions	Content/Themes/Skills	Resources and Materials	Suggested Strategies	Suggested Assessments
What is the importance of career education?	Students will understand the importance of career planning as it relates to a chosen field Students will be able to explain how career education will offer them the opportunity to wok in their chosen fields	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Online resources	Students use an online career planner to map out future career possibilities Multimedia presentation Dialogue & discussion Video presentation Research report	Written report Presentation Class participation
What can be done to enhance a student's knowledge of career education?	Students will understand and be able to explain what resources can be utilized to enhance their knowledge in the area of career education Students will be able to explain how special training and/or certifications can aid them when exploring career opportunities	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic simulator Circuit simulator Online resources	Multimedia presentation Dialogue & discussion Video presentation Research report	Written report Presentation Class participation
How can career education be utilized?	Students will understand and be able to explain how they can use this information to modify their decisions and actions with regards to career choices	Classroom supplies for technological learning activities (TLA) Current textbook and resource binder Multimedia/interactive white board presentation Internet Textbook Hand-outs Logic simulator Circuit simulator Online resources	Multimedia presentation Dialogue & discussion Video presentation Research report	Written report Presentation Class participation

WORK.9-12.9.1.12A.2	Evaluate academic and career skills needed in various career clusters.
WORK.9-12.9.1.12A.3	Analyze factors that can impact an individual's career.

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