Electrical Technology I

Revised UBD Curriculum
Egg Harbor Township High School
Industrial Arts Department

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DISTRICT MISSION STATEMENT

Our mission in the Egg Harbor Township School District is to partner with the student, family, school, and community to provide a safe learning environment that addresses rigorous and relevant 21st Century standards and best practices which will develop academic scholarship, integrity, leadership, citizenship, and the unique learning style of students, while encouraging them to develop a strong work ethic and to act responsibly in their school community and everyday society.

CAREER AND TECHNICAL EDUCATION

Mission:

New Jersey's Office of Career and Technical Education seeks to prepare students for career opportunities of the 21st century, succeed as global citizens and support healthy economic growth for New Jersey. Career and Technical Education prepares students to succeed as global citizens for career opportunities for the 21st Century and to support healthy economic growth within the state.

INTRODUCTION

The most precious resource teachers have is time. Regardless of how much time a course is scheduled for, it is never enough to accomplish all that one would like. Therefore, it is imperative that teachers utilize the time they have wisely in order to maximize the potential for all students to achieve the desired learning.

High quality educational programs are characterized by clearly stated goals for student learning, teachers who are well-informed and skilled in enabling students to reach those goals, program designs that allow for continuous growth over the span of years of instruction, and ways of measuring whether students are achieving program goals.

EGG HARBOR TOWNSHIP SCHOOL DISTRICT CURRICULUM TEMPLATE

The Egg Harbor Township School District has embraced the backward-design model as the foundation for all curriculum development for the educational program. When reviewing curriculum documents and the Egg Harbor Township curriculum template, aspects of the backward-design model will be found in the stated enduring *understandings/essential questions, unit assessments,* and *instructional activities*. Familiarization with backward-design is critical to working effectively with Egg Harbor Township's curriculum guides.

GUIDING PRINCIPLES: WHAT IS BACKWARD DESIGN?

WHAT IS UNDERSTANDING BY DESIGN?

"Backward design" is an increasingly common approach to planning curriculum and instruction. As its name implies, "backward design" is based on defining clear goals, providing acceptable evidence of having achieved those goals, and then working 'backward' to identify what actions

need to be taken that will ensure that the gap between the current status and the desired status is closed.

Building on the concept of backward design, Grant Wiggins and Jay McTighe (2005) have developed a structured approach to planning programs, curriculum, and instructional units. Their model asks educators to state goals; identify deep understandings, pose essential questions, and specify clear evidence that goals, understandings, and core learning have been achieved.

Program based on backward design use desired results to drive decisions. With this design, there are questions to consider, such as: What should students understand, know, and be able to do? What does it look like to meet those goals? What kind of program will result in the outcomes stated? How will we know students have achieved that result? What other kinds of evidence will tell us that we have a quality program? These questions apply regardless of whether they are goals in program planning or classroom instruction.

The backward design process involves three interrelated stages for developing an entire curriculum or a single unit of instruction. The relationship from planning to curriculum design, development, and implementation hinges upon the integration of the following three stages.

Stage I: Identifying Desired Results: Enduring understandings, essential questions, knowledge and skills need to be woven into curriculum publications, documents, standards, and scope and sequence materials. Enduring understandings identify the "big ideas" that students will grapple with during the course of the unit. Essential questions provide a unifying focus for the unit and students should be able to answer more deeply and fully these questions as they proceed through the unit. Knowledge and skills are the *"stuff"* upon which the understandings are built.

Stage II: Determining Acceptable Evidence: Varied types of evidence are specified to ensure that students demonstrate attainment of desired results. While discrete knowledge assessments (e.g.: multiple choice, fill-in-the-blank, short answer, etc...) will be utilized during an instructional unit, the overall unit assessment is performance-based and asks students to demonstrate that they have mastered the desired understandings. These culminating (summative) assessments are authentic tasks that students would likely encounter in the real-world after they leave school. They allow students to demonstrate all that they have learned and can do. To demonstrate their understandings students can explain, interpret, apply, provide critical and insightful points of view, show empathy and/or evidence self-knowledge. Models of student performance and clearly defined criteria (i.e.: rubrics) are provided to all students in advance of starting work on the unit task.

Stage III: Designing Learning Activities: Instructional tasks, activities, and experiences are aligned with stages one and two so that the desired results are obtained based on the identified evidence or assessment tasks. Instructional activities and strategies are considered only once stages one and two have been clearly explicated. Therefore, congruence among all three stages can be ensured and teachers can make wise instructional choices.

At the curricular level, these three stages are best realized as a fusion of research, best practices, shared and sustained inquiry, consensus building, and initiative that involves all stakeholders. In this design, administrators are instructional leaders who enable the alignment between the curriculum and other key initiatives in their district or schools. These leaders demonstrate a clear purpose and direction for the curriculum within their school or district by providing support for implementation, opportunities for revision through sustained and consistent professional development, initiating action research activities, and collecting and evaluating materials to ensure alignment with the desired results. Intrinsic to the success of curriculum is to show how it aligns with the overarching goals of the district, how the document relates to district, state, or national standards, what a high quality educational program looks like, and what excellent teaching and learning looks like. Within education, success of the educational program is realized through this blend of commitment and organizational direction.

INTENT OF THE GUIDE

This guide is intended to provide teachers with course objective and possible activities, as well as assist the teacher in planning and delivering instruction in accordance with the New Jersey Core Curriculum Content Standards. The guide is not intended to restrict or limit the teacher's resources or individual instruction techniques. It is expected that the teacher will reflectively adjust and modify instruction and units during the course of normal lessons depending on the varying needs of the class, provided such modified instruction attends to the objectives and essential questions outlined below.

Electrical Technology- Power Standards

Standard Number	Standard
Marking Period 1	**Safety Coordination with an Introduction to Circuit Design Mathematics**
9.3.ST-SM.1	Describe and follow safety, health and environmental standards related to technology, engineering and mathematics (STEM) workplaces.
9.3.ST-ET.2	Display and communicate STEM information.
9.3.ST-SM.1	Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.
Marking Period 2	**Mathematics: Advanced Circuit Analysis**
9.3.ST.2	Use technology to acquire, manipulate, analyze and report data.
9.3.ST.4	Understand the nature and scope of the science, technology, engineering & mathematics.
9.3.ST-ET.5	Apply the knowledge learned in STEM to solve problems.
Marking Period 3	**Language Arts: Reading, Writing, and Communicating a Technical Proficiency**
TECH.8.2.12.E.4	Use appropriate terminology in conversation (e.g., troubleshooting, peripherals, diagnostic software)
9.3.12.AC-DES.2	Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.
9.3.12.AC.6	Read, interpret and use technical drawings, documents and specifications to plan a project.
Marking Period 4	**Electrical Technology Careers Providing Gainful Employment**
9.3.ST.5	Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the STEM career pathways.
9.3.ST-SM.2	Apply science and mathematics concepts to the development of plans, processes and projects.

9.3.ST-SM.3	Analyze the impact that science and mathematics has on society.

Unit 1 Name: SAFETY:TOOLS AND EQUIPMENT/INTRODUCTION TO DESIGN MATH

Time Frame: 8 WEEKS/1ST QUARTER

Author: Industrial Technology Committee

UNIT

Subject: **Industrial Technology** Country: **USA**

Course/Grade: **Electrical/Grade 10-12** State/Group: **NJ**

School: **Egg Harbor Township High school**

UNIT SUMMARY: Electrical wiring requires you work with two types of electrical current, AC and DC. Most technicians are required to have skillsets allowing them to run wire, connect wire terminals, and test devices and appliances. Screwdrivers, utility knife, wire strippers, wire cutters, claw hammer, channel-lock pliers, needle nose pliers, level, digital-volt-multimeter, ruler, pencil, occupationally specific Material Safety Data Sheets.

Students are introduced to the logistics of engineering hardware. Circuits operating within the binary number system employing equations that become operating circuits with data to support unique hardware decision making capability becoming the core to improve numerical cognition. This introductory skill considers the number of decisions possible as 2, to the x function, with a maximum count to establish a finite number range.

UNIT RESOURCES: Coil or length of 14/2, side cutters, knife, ruler, pliers, wire stripper, utility knife, twelve rules of algebra needed to simplify and interpret design equations. Internet Resource Links:

www.basicelectricity.com www.romex.com

www. electricwiringtools.com

www.electricsafety.com

www.boolean algebra.com

www.boolean equations.com

STAGE ONE

GOALS AND STANDARDS:

1. **Student will be able to do wire termination.**
2. **Student will be able to remove insulation from wire.**
3. **Student will be able to identify electrical careers.**
4. **Student will be able to do wiretaps.**
5. **Student will be able to do symbol recognition, calculate the number of possible logic inputs requiring circuit decisions, with a maximum count to establish finite number range.**
6. **Student will be able to do basic equation writing that details the decision making process in circuit hardware.**
7. **Student will be able to do circuit formulations of equations based on the evaluation of the hardware logistics.**

ENDURING UNDERSTANDING: Local municipalities, where job permits are issued requiring licensed electricians and contractors to perform code enforced wiring tasks. Wiring tasks performed by unlicensed individuals can result in punitive fines with scheduled court appearances.

New technology evolves from the revisions made to old technology. Level 1 design methods introduced in this unit will become integrals to more complicated circuit designs that fabricate into processes having more memory power and speed.

ESSENTIAL QUESTIONS:

1. **How do you use basic electrical tools?**
2. **How do you install an electrical circuit?**
3. **How do you write a math equation?**

KNOWLEDGE AND SKILLS:

Using National Electric Code as a guide, connect a 24" length of 14/2 into a steel outlet box, terminate the wire ends to terminal screws and secure ground wire connections.

Safety and the correct use of tools should be the top priority of this lesson. Incorrect use of tools and incorrect use of tools will become the prime reason for most accidents. Questions on safety reviews should be asked at any time during

the lesson.

Student will have the foundational skills needed to read and explore equation writing from hardware circuits designed to make decisions based on machine language.

STAGE TWO

PERFORMANCE TASKS:

1. **Student will be asked to work from a blueprint to install electrical circuits.**
2. **Student will be asked to identify improperly mounted electrical devices.**
3. **Student will be asked to use the DVM to locate open feeders.**
4. **Student will be asked to use a receptacle tester to identify improperly wired receptacles.**
5. **Student will be able to write simple algebra equations.**
6. **Student will be able to write intermediate level equations with first and second levels of decision making.**

OTHER EVIDENCE: Compare and evaluate your work to the class prototype available for each student to view. Quizzes and tests will be used to measure classroom achievement with classroom discussion and teacher observation of classroom assignments.

9.3 – Career & Technical Education (CTE)

SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS CAREER CLUSTER®

By the end of Grade 12, Career and Technical Education Program completers will be able to:

CAREER CLUSTER®: SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS (ST)

9.3.ST.1 Apply engineering skills in a project that requires project management, process control and quality assurance.

9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.

9.3.ST.3 Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.

9.3.ST.4 Understand the nature and scope of the Science, Technology, Engineering & Mathematics Career Cluster and the role of STEM in society and the economy.

9.3.ST.5 Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways.

9.3.ST.6 Demonstrate technical skills needed in a chosen STEM field.

PATHWAY: ENGINEERING & TECHNOLOGY CAREER PATHWAY (ST ET)

9.3.ST ET.1 Use STEM concepts and processes to solve problems involving design and/or production.

9.3.ST ET.2 Display and communicate STEM information.

9.3.ST ET.3 Apply processes and concepts for the use of technological tools in STEM.

9.3.ST ET.4 Apply the elements of the design process.

9.3.ST ET.5 Apply the knowledge learned in STEM to solve problems.

9.3.ST ET.6 Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.

PATHWAY: SCIENCE & MATHEMATICS CAREER PATHWAY (ST_SM)

9.3.ST SM.1 Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.

9.3.ST SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.

Using the appropriate wiring procedure ground all terminations inside the steel outlet box. During the final phase, plastic boxes will have

the appropriate device ground.

9.3.ST SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

Career Ready Practices

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP3. Attend to personal health and financial well-being.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP10. Plan education and career paths aligned to personal goals. **CRP11.**
Use technology to enhance productivity.

CRP1. **Act as a responsible and contributing citizen and employee.**
Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

CRP2. Apply appropriate academic and technical skills.
Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

CRP3. Attend to personal health and financial well-being.
Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.

CRP4. Communicate clearly and effectively and with reason.
Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

CRP5. Consider the environmental, social and economic impacts of decisions.
Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

CRP6. Demonstrate creativity and innovation.
Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

CRP7. Employ valid and reliable research strategies.
Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. Career ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

CRP9. Model integrity, ethical leadership and effective management.
Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.

CRP10. Plan education and career paths aligned to personal goals.
Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

CRP11. Use technology to enhance productivity.
Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

OTHER EVIDENCE: Safe electrical wiring requires all wire splices be made inside electrical outlet boxes. Electrical outlet boxes can be grounded steel outlet boxes or plastic outlet boxes with electrical ground wires connected to the device.

Math equations will be checked for accuracy with the data retrieved from circuit operation.

STAGE THREE

LEARNING PLAN: Have the student complete wire termination as a job consisting of operations individually taught and now being applied as a job on an employable task.

Have students write a series of equations with verified data. Then take the equations and construct a group of circuits that work according to the mathematics draft.

Unit 2 Name: MATHEMATICS/ADVANCED CIRCUIT ANALYSIS/BLUEPRINTS & INSTRUMENTS

Time Frame: 4 WEEKS

Author: Industrial Technology Committee

UNIT

Subject: **Industrial Technology** Country: **USA**

Course/Grade: **Electrical/Grade 10-12** State/Group: **NJ**

School: **Egg Harbor Township High School**

UNIT SUMMARY: Your ability to perform in this industry will become a factor of your performance to complete rough-in wiring, final wiring, and successfully pass job inspections required of your job permits. Blueprints will measure your ability to safely install electrical circuits as drafted by a building engineer who has had plans approved by the local municipality. Circuits laid out on blueprints do not provide procedures for wiring nor wire sizes. Device location, quantity per room, and product specs could be linked to preferred product manufacturers. All other procedures become your responsibility as the electrical contractor endorsed by the National Electrical Code (NEC).

Understanding how to use the digital volt multimeter (aka DVM) will enhance your career. This instrument will be your eyes, ears, and nose when electrical parameters emerge contentious. This instrument will carry you across many "difficult rivers" when circuits stop working and short circuits burn-out and destroy devices. On the days when your ability to correctly wire circuits and connect machine terminals, becomes a dark chasm of uncertainty, your continuity tests, voltage measurements and current levels will technically establish your talent.

The mathematics used in circuit analysis will require another level of student proficiency. The student is now required to write or select an equation from which the hardware will be drafted with a determination of inputs and maximum count. The student will simplify the equation, which we will call the original equation, construct the hardware for the original equation and collect operational data. The original equation will be simplified and the result will be called a simple equation. the simple equation will be simplified and data will be collected to determine if the original equation and the simple equation operate in an identical manner. If the two equations result in identical hardware data, a hardware analysis will be performed to determine which equation operates with the least amount of hardware. The equation-circuit with the least amount of hardware becomes the fabricated design. The student is now moving into a level 1 engineering proficiency.

UNIT RESOURCES: Basement Electrical and First Floor Electrical Blueprint. Digital Volt Multimeter with a trainer board that allows you practice making continuity measurements, voltage and current measurements.

Drafted circuit designs will be constructed on battery powered superstrips. The circuits can be built using universal nand/nor logic or 74XX integrated circuit chips. Binary inputs will be switched from dip switches where 0 volts represents a logic 0, and a logic 1 exists when +5 volts becomes an input.

Internet Resource Links:

www.http://electricalblueprint.com

www.http://blueprintscale.com www.http://blueprintsymbols.com

www.http://digitalmultimeter.com

www.http://electricalinstruments.com

www.http://electricaldesign.com

www.http://logicsimplification.com

www.http://minterm.com

www.http://maxterm.com

STAGE ONE

GOALS AND STANDARDS:

1. **Student will be able to do a scaled blueprint read.**
2. **Student will be able to do electrical symbol interpretation.**
3. **Student will be able to do electrical circuit installations as stipulated in the National Electrical Code.**
4. **Student will be able to do rough-in wiring and final device wiring with appropriate electrical inspections.**
5. **Student will be able to do voltage, current, and resistance measurements to isolate or eliminate the questionable status of an electrical part at the power or control level.**
6. **Student will be able to do parameter scaling on a DVM.**
7. **Student will be able to draft an example of an electrical power circuit.**
8. **Student will be able to draft an example of an electrical control circuit.**
9. **Student will be able to draft a math equation from the detail of a constructed circuit.**

10. **Student will be able to simplify an equation representing a circuit action.**
11. **Student will be able to do a hardware analysis on equations identified as original or simple.**

ENDURING UNDERSTANDING: In the state of New Jersey, to work on a residential electrical service, or to contract an electrical job, YOU MUST be licensed by the State Board of Electrical Contractors, Halsey Street, in Newark NJ. To become licensed you must apply to the State Board with proof of work experience verified with federal income tax returns. Upon passing the electrical exam, you must secure contractor insurance and provide---upon request every three years-- 34 hours of Continuing Education (CE). Failure to acquire and provide proof of CE will result in huge fines and the suspension or revocation of your license.

This industry has two (2) very diverse divisions: 1) power circuits and 2)control circuits. Power circuits utilize high levels of voltage and current to perform at some level of horsepower. Control circuits can be generic or customized. They are usually designed from equations and tested in controlled environments to verify reliability and operability.

ESSENTIAL QUESTIONS:

1. **How do you read, interpret and work from an electrical blueprint?**
2. **How do you secure an electrical permit?**
3. **How do you measure electrical parameters with Digital Volt-Multimeter (DVM)?**
4. **How do you design a control circuit that merges two input parameters as an "and" function and then "or" the result in a second level of logic.**
5. **Convert the equation A+[(AB)(BC)] into hardware.**
6. **How do you simplify X = (BC)(DC).**

KNOWLEDGE AND SKILLS:

The electrical blueprint is a STEM product with your electrical components as the science, the applied circuit wiring as the technology, the building plan drafted and approved by a certified civil engineer, and the math scale on the print which allows you to compare "scaled size" with "actual size".

Incorrect DVM use could result in blowing the meter fuse, damaging the meter, or creating a condition called loading the meter with too high resistance readings which gives incorrect quantified readings.

An important rubric for level 1 engineering will be the ability of a student to simplify an original equation, construct the hardware, and conduct a hardware analysis for fabrication in minterm or maxterm form.

STAGE TWO

PERFORMANCE TASKS:

1. **Starting with the Basement Electrical Blueprint, establish the print scale before calculating the total square footage of the basement, thickness of the concrete poured basement walls, size of the basement windows, and the number of doors.**
2. **Electrically, determine the number of receptacles (polarized or GFCI), single pole switches, 3-way switches, 4-way switches, recessed and surface lighting fixtures, baseboard heating, chimes, cable television outlets, telephone jacks, etc. Then determine wire sizes and approximate linear lengths.**
3. **Design a control circuit that will detect 4,2,6,and 7. The circuit will be used to drive a decoder circuit for a numerical display. Draft the equation with the original circuit, simplify the equation to reduce hardware, construct the simple equation. Perform a data analysis on both the original and the simple circuits to verify identical logic outputs. List the hardware specifications for original and simple circuits to determine the most efficient draft and to determine the benefits of the math reduction.**

9.3 – Career & Technical Education (CTE)

SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS CAREER CLUSTER®

Number Standard Statement

By the end of Grade 12, Career and Technical Education Program completers will be able to:

CAREER CLUSTER®: SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS (ST)

9.3.ST.1 Apply engineering skills in a project that requires project management, process control and quality assurance.

9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.

9.3.ST.3 Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.

9.3.ST.4 Understand the nature and scope of the Science, Technology, Engineering &

Mathematics Career Cluster and the role of STEM in society and the economy.

9.3.ST.5 Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways.

9.3.ST.6 Demonstrate technical skills needed in a chosen STEM field.

PATHWAY: ENGINEERING & TECHNOLOGY CAREER PATHWAY (ST ET)

9.3.ST ET.1 Use STEM concepts and processes to solve problems involving design and/or production.

9.3.ST ET.2 Display and communicate STEM information.

9.3.ST ET.3 Apply processes and concepts for the use of technological tools in STEM.

9.3.ST ET.4 Apply the elements of the design process.

9.3.ST ET.5 Apply the knowledge learned in STEM to solve problems.

9.3.ST ET.6 Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.

PATHWAY: SCIENCE & MATHEMATICS CAREER PATHWAY (ST_SM)

9.3.ST SM.1 Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.

9.3.ST SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.

9.3.ST SM.3 Analyze the impact that science and mathematics has on society.

Using the appropriate voltage & current range take parameter measurements on a series, parallel, and combination circuit. Perform continuity measurements on the devices provided.

SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS CAREER CLUSTER®

Number Standard Statement

9.3.ST SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

Career Ready Practices

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP3. Attend to personal health and financial well-being.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP10. Plan education and career paths aligned to personal goals.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence.

CRP1. **Act as a responsible and contributing citizen and employee.**
Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

CRP2. Apply appropriate academic and technical skills.

Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

CRP3. Attend to personal health and financial well-being.
Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.

CRP4. Communicate clearly and effectively and with reason.
Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

CRP5. Consider the environmental, social and economic impacts of decisions.
Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

CRP6. Demonstrate creativity and innovation.
Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

CRP7. Employ valid and reliable research strategies.
Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. Career-ready

individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

CRP9. Model integrity, ethical leadership and effective management.
Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.

CRP10. Plan education and career paths aligned to personal goals.
Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

CRP11. Use technology to enhance productivity.
Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

CRP12. Work productively in teams while using cultural global competence.
Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

OTHER EVIDENCE: Compare and evaluate your work to the classroom sample available for each student to view. Quizzes and tests will be used to measure classroom activity along with classroom discussion and teacher observation of classroom assignments. In engineering your ability to design circuits becomes your level of proficiency.

STAGE THREE

LEARNING PLAN: Have the student install and wire an electrical circuit as a job consisting of a number of operations individually taught and now being applied as a job on an employable task.

Engineering students need to practice the design procedures that create numerical detection circuits with verified logic states in the data table.

Unit 3 Name: PERFORMING THE ROUGH-IN PHASE OF ELECTRICAL WIRING/LANGUAGE ARTS PROFICIENCY

Time Frame: 10 WEEKS

Author: Industrial Technology Committee

UNIT

Subject: **Industrial Technology**

Country: **USA**

Course/Grade: **Electrical/Grade 10-12**

State/Group: **NJ**

School: **Egg Harbor Township High school**

UNIT SUMMARY: The first official inspection is called the "rough-in" when the electric service has been installed, outlet boxes are in place, and wire routing is complete. Before the walls have been "closed in" and receptacles, switches, luminaires (lighting fixtures), and other electrical equipment has been installed, the inspection allows the inspector to verify that service, branch circuits, and outlet locations comply with the National Electric Code requirements.

In this program vocabulary and writing is taught both individually and in small groups, and it is the teacher who decides which is the best individual approach for each student. Teaching individualized writing can be as varied as the creative insights of the teacher and the diverse needs of the student. Self-selection is part of the process; students can choose from a wide range of reading materials. When he/she wishes, a student may write about a variety of technical books and stories, concentrating if he/she chooses on STEM. From the beginning, the student is encouraged to browse, to pursue individual interests, to read for pleasure and for information. The only restraints placed on the student are that he/she must read and write something during a given period of time, be responsible for completing a writing report form, attend a student-teacher writing conference, and be prepared to share the written material with a small group of fellow students.

UNIT RESOURCES: Classroom frame structure, romex wire sizes 14/2, 12/2, 12/3, 10/2, and 10/3. Steel outlet boxes with ground screws, plastic outlet boxes, nails or screws, staples, standard tool pouch, ceiling fan boxes for ceiling fans.

Effective writing is the result of practice, more practice, and a commitment to writing in complete sentences.

Internet Resource Links:

www.http://buildingpermit.com

www.http://NECA.com

www.http://OSHA.org

www.http://NEIS.com

www.http://NFPA.com

www.http://technicalwriting.com

www.http://technicalreporting.com

STAGE ONE

GOALS AND STANDARDS

1. **Student will be able to do a scaled index of the National Electric Code.**
2. **Student will be able to do NEC referencing of buildings and dwelling units.**
3. **Student will be able to do relationship referencing of NEC and other buildings.**
4. **Student will be able to do wiring practices enforced by official Code terminology.**
5. **Student will be able to do approved product installations.**
6. **Move away from reading and writing as "subjects" and begin to think of them in broader terms as an important part of the total language experience.**
7. **Provide ways to help students find enjoyment in reading and writing.**
8. **Talk with students and find out what their individual reading interests are. Provide ways to help them enhance and extend their interests.**
9. **Provide a variety of reading materials for students and help them grow toward self-selection.**
10. **Provide the student with the fundamental reading skills in:**
    _____a. recognizing words
    _____b. defining word meanings

_____c. comprehending and interpreting what is written
_____d. reading silently at speeds appropriate to the material and purpose of reading
_____e. reading orally
_____f. using books efficiently.

ENDURING UNDERSTANDING: When an inspector finds Code violations on a job in progress, he or she typically leaves behind a list of deficiencies (or corrections) that must be implemented before a "work approval" is granted. Often this form is posted at the service or next to the electrical permit. Although, it may not be red it is typically called--- in the field---, the 'red tag". Normally, the local jurisdiction will grant an occupancy permit only when all corrections have been made and the AHJ (Authority Having Jurisdiction) has approved the job.

Again, variety and individualization are the keys to this writing program. This writing program, like the language arts program presented here, takes advantage of eclecticism. It is the teacher's responsibility to know different approaches and methods and materials and to apply this knowledge to the individual student. An awareness of the different techniques that have been developed will better qualify the teacher to select an approach that will offer a student his/her greatest chance of success.

ESSENTIAL QUESTIONS:

1. **How do you work safely in the electrical trades?**
2. **How do you apply for electrical permits?**
3. **When does the electrician call for an inspection?**
4. **How do you rough-in a two-family dwelling?**
5. **How do you route romex wire between wall studs?**
6. **How do you write with comprehension?**
7. **How do you write in complete sentences?**
8. **How do you write creatively?**

KNOWLEDGE AND SKILLS:

The rating of a branch circuit is not determined by conductor size, but by the rating of its overcurrent device. A 15-ampere branch circuit is protected by a 15-ampere circuit breaker or fuse. If a 20-ampere overcurrent device exceeds 80% of its overcurrent rating, it's technically a 30-ampere branch circuit.

Provide students with opportunities to share experiences and listen to each other. Stimulate students to write meaningfully about a variety of personal observations, explorations, and ideas.

STAGE TWO

PERFORMANCE TASKS:

Using the pseudo-blueprint provided, perform the rough-in wiring phase in the stick house. Inspection compliance will determine your assigned grade. The grading rubric will result in a 10 point deduction for each violation. Example: If a student has two (2) rough-in violations, the grade for this task will be 80% instead of the perfect score of 100%.

The general view taken in this program of "non-readers" or "poor readers" is that these students' problems result either from an inadequate decoding instruction or from personal characteristics such as faulty perception, poor motivation, or emotional disturbance that are general learning problems not confined only to reading and, therefore, not treatable solely as reading problems. Students will therefore read and write weekly to encourage technical fluency.

9.3 – Career & Technical Education (CTE)

SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS CAREER CLUSTER®

Number Standard Statement

By the end of Grade 12, Career and Technical Education Program completers will be able to:

CAREER CLUSTER®: SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS (ST)

9.3.ST.1 Apply engineering skills in a project that requires project management, process control and quality assurance.

9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.

9.3.ST.3 Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.

9.3.ST.4 Understand the nature and scope of the Science, Technology, Engineering & Mathematics Career Cluster and the role of STEM in society and the economy.

9.3.ST.5 Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways.

9.3.ST.6 Demonstrate technical skills needed in a chosen STEM field.

PATHWAY: ENGINEERING & TECHNOLOGY CAREER PATHWAY (ST ET)

9.3.ST ET.1 Use STEM concepts and processes to solve problems involving design and/or production.

9.3.ST ET.2 Display and communicate STEM information.

9.3.ST ET.3 Apply processes and concepts for the use of technological tools in STEM.

9.3.ST ET.4 Apply the elements of the design process.

9.3.ST ET.5 Apply the knowledge learned in STEM to solve problems.

9.3.ST ET.6 Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.

PATHWAY: SCIENCE & MATHEMATICS CAREER PATHWAY (ST_SM)

9.3.ST SM.1 Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.

9.3.ST SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.

Using the appropriate wiring procedure ground all terminations inside the steel outlet box. During the final phase, plastic boxes will have the appropriate device ground.

SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS CAREER CLUSTER

Number Standard Statement
9.3.ST SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

Career Ready Practices

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP3. Attend to personal health and financial well-being.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP10. Plan education and career paths aligned to personal goals.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence

CRP1. **Act as a responsible and contributing citizen and employee**
Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others.

They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

CRP2. Apply appropriate academic and technical skills.
Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

CRP3. Attend to personal health and financial well-being.
Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.

CRP4. Communicate clearly and effectively and with reason.
Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

CRP5. Consider the environmental, social and economic impacts of decisions.
Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

CRP6. Demonstrate creativity and innovation.
Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

CRP7. Employ valid and reliable research strategies.
Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

CRP9. Model integrity, ethical leadership and effective management.
Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.

CRP10. Plan education and career paths aligned to personal goals.
Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing CRP9. Model integrity, ethical leadership and effective management. Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.
CRP11. Use technology to enhance productivity.
Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.
CRP12. Work productively in teams while using cultural global competence.

Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings, applications, and they take actions to prevent or mitigate these risks.

OTHER EVIDENCE: Compare and evaluate your work to the classroom benchmarks available for each student to view. Quizzes and tests will be used to measure the classroom learning curve along with classroom discussion and grading of classroom assignments.

STAGE THREE

LEARNING PLAN: Have the students complete the rough-in phase of the job consisting of operations which constitute the job skill taught and will now be applied as a gradable performance on an employable task.

This program takes the position that a key feature of remedial work is an emphasis on decoding, usually involving explicit instruction in phonetics. To serve those students who are experiencing extreme difficulty with reading and writing, this program will utilize the approach to reading and writing developed by Caleb Gattegno, called *Words in Color*.

Unit 3 Name: ROUGH-IN WIRING: ELECTRICAL SAFETY/LANGUAGE ARTS/SECTION 1

Time Frame: 5 WEEKS

Author: Industrial Technology Committee

UNIT

Subject: **Industrial Technology** Country: **USA**

Course/Grade: **Electrical/Grade 10-12** State/Group: **NJ**

School: **Egg Harbor Township High School**

UNIT SUMMARY: Electrical safety has ten areas of consideration that need to be verbally explained, instructor demonstrated, and then endorsed in the classroom as a mandated practice. These areas are:

1. **Fall Protection**
2. **Ladder Safety**
3. **Lighting Safety**
4. **Live Panelboards**
5. **Lockout/Tagout Procedures**
6. **National Fire Protection Agency (NFPA) Endorsements**
7. **Overhead Power Lines**
8. **Use of Power Tools**
9. **Writing Procedural Guidelines To Use Personal Protective Equipment (PPE)**
10. **Writing Procedural Guidelines About Personal Work Space Safety**

UNIT RESOURCES: Guardrails and plastic netting, step or extension ladder, illuminated workspaces, panelboard, fire-resistant clothing, flash jackets, hard hat, steel-toed boots, work gloves, safety glasses, lockout/tagout device, battery powered drivers, arc-rated face shields, ear plugs, voltage rated gloves, NFPA & NEC manuals.

Procedural guidelines should outline the types and use of personal protective equipment. The guidelines on personal work space safety should identify what is an appropriate work space and the acceptable guidelines.

Internet Resource Links:

www.NFPA.org

www.staticelectricity.com

www.electricshock.com

www.decibels.com

www.generalsafety.com

STAGE ONE

GOALS AND STANDARDS:

1. **Student will be able to secure a ladder for climbing.**
2. **Student will be able to identify personal protective clothing.**
3. **Student will be able to safely use an extension cord to run power tools.**
4. **Student will be able to demonstrate how to handle a live wire terminal.**
5. **Student will be able to understand how water and electric current interact.**
6. **Student will be able to safely use hand tools.**
7. **Student will be able to administer first aid to cuts, bruises, and burns.**
8. **Student will be able to do a complete written safety report on procedural guidelines for safe work practices and use of safe personal protective equipment.**

ENDURING UNDERSTANDING:

In addition to electrical hazards, construction work also involves other dangers such as falling from roofs and ladders, injuries from dropped tools and materials, and accidents with power tools. The hazards of working around electricity include shock and electrocution, fire, and arc-flash. Arc-flash is a high energy "explosion" that can occur when something happens such as accidental shorting across the bus bars in a residential panelboard by, for example, dropping a pair of pliers.

ESSENTIAL QUESTIONS:

1. **What is an electrical shock?**
2. **What is an electrocution?**
3. **What is a safety rule?**
4. **What is OSHA?**
5. **What is Personal Protective Equipment?**
6. **What is an emergency shut-down switch?**
7. **What is personal workspace safety?**

KNOWLEDGE AND SKILLS:

The National Electric Code requires that illumination be provided for working spaces around service equipment installed indoors. It does not specify a minimum foot-candle level or require dedicated lighting outlets for service equipment.

General or specific safety knowledge should be endorsed by OSHA in order to receive some form of safety certification training.

STAGE TWO

PERFORMANCE TASKS:

Five (5) job sites have been set-up to evaluate the ability of a student to evaluate an unsafe environment or workspace. Students are given a list of safe items to check and compare for safety. Unsafe conditions must be identified with a written recommendation to correct. All corrected electrical violations are supported by learning standards:

9.3 – Career & Technical Education (CTE)

SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS CAREER CLUSTER®

Number Standard Statement

By the end of Grade 12, Career and Technical Education Program completers will be able to:

CAREER CLUSTER®: SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS (ST)

9.3.ST.3 Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.

9.3.ST.5 Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways.

9.3.ST.6 Demonstrate technical skills needed in a chosen STEM field.

9.3.ST‐ET.1 Use STEM concepts and processes to solve problems involving design and/or production.

9.3.ST‐ET.2 Display and communicate STEM information.

9.3.ST‐ET.3 Apply processes and concepts for the use of technological tools in STEM.

9.3.ST‐ET.4 Apply the elements of the design process.

9.3.ST‐ET.5 Apply the knowledge learned in STEM to solve problems.

9.3.ST‐ET.6 Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.

9.3.ST‐SM.1 Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.

9.3.ST‐SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.

9.3.ST‐SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

Career Ready Practices

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP11. Use technology to enhance productivity.

CRP1. **Act as a responsible and contributing citizen and employee**
Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

CRP2. Apply appropriate academic and technical skills.
Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract

concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

CRP4. Communicate clearly and effectively and with reason.
Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

CRP5. Consider the environmental, social and economic impacts of decisions.
Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

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CRP11. Use technology to enhance productivity.
Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

OTHER EVIDENCE: Since unsafe working conditions can be identified as mechanical faults or electrical defects, a dated written record of impending infractions should be available for all to view. Practice completing accident reports are normal procedures to any workplace related environment.

STAGE THREE

LEARNING PLAN: Have students answer questions to a safety test that identifies infractions caused by the lack of personal protective clothing.

Unit 3 Name: ROUGH-IN WIRING:INSTALLATION OF LIGHTING AND RECEPTACLE CIRCUITS/LANGUAGE ARTS/SECTION 2

Time Frame: 5 weeks

Author: Industrial Technology Committee

UNIT

Subject: **Industrial Technology**

Country: **USA**

Course/Grade: **Electrical/Grade 10-12**

State/Group: **NJ**

School: **Egg Harbor Township High School**

UNIT SUMMARY: Using the correct wire size, route 14/2, 12/2, 12/3, 10/2, and 10/3 from the circuit breaker panel to the appropriate room and wall location to accommodate receptacles, lighting circuits, ceiling fans, and heavy duty appliance circuits that comply with an approved blueprint drawing which depicts the structure and the scale of the drawing.

Safety rules pertaining to the installation of lighting and receptacle circuits should be clearly displayed in the area where the installations are taking place.

UNIT RESOURCES: Classroom frame structure, lengths of romex 14/2, 12/2, 12/3, 10/2, and 10/3. Steel outlet boxes with ground screws, plastic outlet boxes, nails or screws, staples, special fan boxes for ceiling fans, cordless or electric drill with ¾" speedbores to route wire through 2x4 studded walls.

General safety posters should not be well written and posted in clear view of the workplace.

Internet Resource Links:

www.ehtbuildingpermit.com

www.romex.com

www.GFCI.com

www.circuitbreaker.com

www.loadcenter.com

www.NEC.com

STAGE ONE

GOALS AND STANDARDS:

1. **Student will be able to wire branch circuit installations.**
2. **Student will be able to wire appliance branch circuit installations.**

3. **Student will be able to determine demand factor calculations.**
4. **Student will be able to wire installations for continuous loads.**
5. **Student will be able to mount electrical outlet boxes.**
6. **Student will be able to splice ground wire circuits.**
7. **Student will be able to write a report on grounding and bonding circuits.**

ENDURING UNDERSTANDING: Many jurisdictions require licensed electrical contractors, and their employed helpers, perform work within the scope of the NEC (National Electric Code). It is important for installers to know and comply with the wiring regulations in the jurisdiction(s) where they work.

Accidents in safe work environments should be evaluated with the recommendation for changes.

ESSENTIAL QUESTIONS:

1. **What is a duplex receptacle?**
2. **What is a lighting load?**
3. **What is a blueprint?**
4. **What is a pseudo-blueprint?**
5. **What is the National Electric Code?**
6. **What is an electrical permit?**
7. **What is an electrical inspection?**
8. **What is a safe work environment?**

KNOWLEDGE AND SKILLS: Knowledge of electrical symbols is important before a student or an employee (aka electrician's helper) can properly choose the correct size wire for an electrical installation. Not all electrical wiring textbooks teach basic electrical theory. It is assumed that the reader will have a basic understanding in electricity and understand such concepts as current, voltage, resistance, and power as derived from Ohm's law.

STAGE TWO

PERFORMANCE TASKS: Students will install a branch circuit from the circuit breaker panel to the wall of the stick house. The branch circuit will be wired in the load center. The feed supply circuit will be connected to appropriate devices identified on the blueprint.

Artistic students should use their talent to create safety posters.

9.3 – Career & Technical Education (CTE)

SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS CAREER CLUSTER

Number Standard Statement

By the end of Grade 12, Career and Technical Education Program completers will be able to:

CAREER CLUSTER®: SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS (ST)

9.3.ST.1 Apply engineering skills in a project that requires project management, process control and quality assurance.

9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.

9.3.ST.3 Describe and follow safety, health and environmental standards related to science,technology, engineering and mathematics (STEM) workplaces.

9.3.ST.4 Understand the nature and scope of the Science, Technology, Engineering & Mathematics Career Cluster and the role of STEM in society and the economy.

9.3.ST.5 Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways.

9.3.ST.6 Demonstrate technical skills needed in a chosen STEM field.

PATHWAY: ENGINEERING & TECHNOLOGY CAREER PATHWAY (ST-ET)

9.3.ST-ET.1 Use STEM concepts and processes to solve problems involving design and/or production.

9.3.ST-ET.2 Display and communicate STEM information.

9.3.ST-ET.3 Apply processes and concepts for the use of technological tools in STEM.

9.3.ST-ET.4 Apply the elements of the design process.

9.3.ST-ET.5 Apply the knowledge learned in STEM to solve problems.

9.3.ST-ET.6 Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.

PATHWAY: SCIENCE & MATHEMATICS CAREER PATHWAY (ST-SM)

9.3.ST-SM.1 Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.

9.3.ST-SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.

Using the appropriate wiring procedure ground all terminations inside the steel outlet box. During the final phase, plastic boxes will have the appropriate device ground.

SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS CAREER CLUSTER

Number Standard Statement

9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

Career Ready Practices

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP11. Use technology to enhance productivity.

CRP1. **Act as a responsible and contributing citizen and employee**

Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

CRP2. Apply appropriate academic and technical skills.
Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

CRP4. Communicate clearly and effectively and with reason.
Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

CRP5. Consider the environmental, social and economic impacts of decisions.
Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

CRP6. Demonstrate creativity and innovation.
Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

CRP9. Model integrity, ethical leadership and effective management.
Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.

CRP11. Use technology to enhance productivity.
Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

OTHER EVIDENCE: Article 100 of the National Electric Code contains definitions. Many apply broadly to all types of electrical installations. Others are primarily related to commercial, industrial, and occupational construction and have little to do with residential wiring. Students having a first exposure to the NEC should understand the wriiten definition of safety.

STAGE THREE

LEARNING PLAN: Divide the class into teams of students that will perform the rough-in phase of residential wiring. Allow each team to work from a blueprint requiring them to interpret and identify electrical symbols that locate receptacles, lights, and other devices commonly found in residential structures. From the blueprint, students should be able to identify jobs carrying some level of risk.

Unit 4 Name: PERFORMING THE FINAL PHASE OF ELECTRICAL WIRING/CAREER EXPLORATION

Time Frame: 10 WEEKS

Author: Industrial Technology Committee

UNIT

Subject: **Industrial Technology**

Country: **USA**

Course/Grade: **Electrical/Grade 10-12**

State/Group: **NJ**

School: **Egg Harbor Township High school**

UNIT SUMMARY: Electrical inspections take place when electrical installations are complete. The second official inspection takes place when a scheduled time and place has been given. This inspection allows the inspector to verify that the electrical system operates safely, GFCI and AFCI protection are in place, and that all applicable Code requirements have been met.

Usually careers are chosen after many questions are answered to determine the viability of interest:

What do workers in this job actually do?

What are their tasks, responsibilities, risks, and physical demands of this occupation?

What training, education, or other qualifications (licenses, registration, and certification) do you need for the occupation?

What is the work environment like (workload, pace, people)?

How does it look, sound and smell?

What is the work schedule like? (Hours per week, hours per day, overtime, travel)

What are the earnings or salary ranges?

What is the employment outlook for this occupation?

What are the possibilities for advancement or promotion?

What are some related occupations?

What are some sources of additional information (books, schools, people, web sites)?

UNIT RESOURCES: Classroom frame structure, receptacles, switches, GFCI's, AFCI's, lighting, ceiling fans, appliances, etc.

Access to a guidance counselor. Opportunity to attend a career fair.

Internet Resource Links:

www.http://buildinginspections.com

www.http://gfci.com www.http://afci.org

www.http://electricmeters.com

www.http://mainbondingjumpers.com

www.http://electricalcareers.com

www.http://electricalindustry.com

www.http://dictionaryofoccupationaltitles

.

com

STAGE ONE

GOALS AND STANDARDS:

1. **Student will be able to connect devices specified on the jobsite blueprint.**
2. **Student will be able to connect appliances to the appropriate branch circuit.**
3. **Student will be able to connect luminaires, lighting tracks, and ceiling fans.**
4. **Student will be able to connect continuous loads protected by overcurrent devices.**

5. **Student will be able to do standard product installations identified as an electric range, washer/dryer unit, waste disposer, television, refrigerator, central heating unit, etc.**

6. **Seek work and volunteer experiences in and out of school. And from a practical standpoint, work experience looks good on college applications — and on future job applications and resumes. And one other benefit if you are working in a paid position: spending money! Just remember that school and grades have to come first, so only work if you can balance your schedule, manage your time**

<u>ENDURING UNDERSTANDING</u>: When an inspector finds Code violations on a job in progress, he or she typically leaves behind list of deficiencies that must be corrected before approval will be granted. Often this form is posted at the service, or next to the electrical permit, and is typically called the 'red tag' in the field (although it may not be red). Normally, the locally jurisdiction will grant an occupancy permit, and the local utility will turn on power, only when all deficiencies have been corrected and the AHJ (Authority Having Jurisdiction) has approved the job.

We are now a society in which many jobs and careers require additional education or training beyond high school. Some careers even require a graduate degree before you can work in the field. Take advantage of all educational opportunities that come your way, such as summer educational opportunities and educational trips abroad. If financially possible — and there are many ways to help make it so — attend college; college graduates make a much higher salary, on average, than high-school graduates.

<u>ESSENTIAL QUESTIONS</u>:

1. **How do you test electrical appliances?**
2. **How do you calculate the service load?**
3. **How do you determine the wire size for a branch circuit?**
4. **What appliances require GFCI protection?**
5. **What appliances operate on 120/220vac?**
6. **How do you choose a career?**
7. **How do you choose a new career?**

<u>KNOWLEDGE AND SKILLS</u>:

The rating of a branch circuit is not determined by conductor size, but by the rating of its overcurrent device. A 15-ampere branch circuit is protected by a 15 ampere circuit breaker or fuse. If an operating 20-ampere overcurrent device exceeds 80% of its overcurrent rating, it technically becomes a 30-ampere branch circuit.

There are so many opportunities, so many different types of jobs and careers in a wide variety of industries — and there are also other career paths that are just

emerging. Even if you are fairly sure of a career choice, take the time in high school to explore similar (or even vastly different) careers. Explore all your options. Examine your likes and dislikes and take a few career-assessment tests. Answer the question, if you could have any job right now, what would it be — and why? Don't let any barriers hold you back from finding the perfect career.

STAGE TWO

PERFORMANCE TASKS:

Using the blueprint provided perform all device connections in the stick house. Your work will be inspected. The rubric for this task will result in a performance grade. If a student has two (2) rough-in violations, the grade for this task will be 80% instead of the perfect score of 100%.

Take advantage of all educational opportunities that come your way, such as summer educational opportunities and educational trips abroad. If financially possible — and there are many ways to help make it so — attend college; college graduates make a much higher salary, on average, than high-school graduates.

9.3 – Career & Technical Education (CTE)

SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS CAREER CLUSTER

Number Standard Statement

By the end of Grade 12, Career and Technical Education Program completers will be able to:

CAREER CLUSTER®: SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS (ST)

9.3.ST.1 Apply engineering skills in a project that requires project management, process control and quality assurance.

9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.

9.3.ST.3 Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.

9.3.ST.4 Understand the nature and scope of the Science, Technology, Engineering &

Mathematics Career Cluster and the role of STEM in society and the economy.

9.3.ST.5 Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways.

9.3.ST.6 Demonstrate technical skills needed in a chosen STEM field.

PATHWAY: ENGINEERING & TECHNOLOGY CAREER PATHWAY (ST_ET)

9.3.ST ET.1 Use STEM concepts and processes to solve problems involving design and/or production.

9.3.ST ET.2 Display and communicate STEM information.

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9.3.ST ET.4 Apply the elements of the design process.

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PATHWAY: SCIENCE & MATHEMATICS CAREER PATHWAY (ST_SM)

9.3.ST SM.1 Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.

9.3.ST SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.

Using the appropriate wiring procedure connect ground wire terminations inside the steel outlet box. During the final phase, plastic boxes will have the appropriate device ground.

SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS CAREER CLUSTER

Number Standard Statement

9.3.ST SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

Career Ready Practices

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP3. Attend to personal health and financial well-being.
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CRP7. Employ valid and reliable research strategies.
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CRP9. Model integrity, ethical leadership and effective management.
CRP10. Plan education and career paths aligned to personal goals.
CRP11. Use technology to enhance productivity.

CRP1. Act as a responsible and contributing citizen and employee

Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

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appropriate to apply the use of an academic skill in a workplace situation.

CRP3. Attend to personal health and financial well-being.
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Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

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CRP7. Employ valid and reliable research strategies.
Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving

them.
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CRP10. Plan education and career paths aligned to personal goals.
Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

CRP11. Use technology to enhance productivity.
Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

OTHER EVIDENCE: Compare and evaluate your work to the classroom benchmark available for each student to view. Performance quizzes and tests will be used to measure proficiency and

skill development.

STAGE THREE

LEARNING PLAN: Have the students complete the final phase of the job with device and appliance connections tested and verified as operating properly. Student operations previously taught can now be graded as an employable task.

Believe it or not, if you're in high school right now, you're at a great point in your life. You have your whole life in front of you. And now is a good time to start thinking about your future, to make some initial plans; just remember that plans can be easily changed. Remember too, that experts predict that the average person will change careers — not just jobs — more than five times in his or her lifetime. Now is the time to pursue your dreams!

Unit 4 Name: FINAL PHASE WIRING:CONNECTING ELECTRICAL DEVICES/CAREERS/ SECTION 1
Time Frame: 5 WEEKS

Author: INDUSTRIAL TECHNOLOGY COMMITTEE

UNIT

Subject: **Industrial Technology**

Country: **USA**

Course/Grade: **Electrical/Grade 10-12**

State/Group: **NJ**

School: **Egg Harbor Township High School**

UNIT SUMMARY: With a review of your electrical symbols, single pole electrical switches will be connected in series, multiple lamp loads controlled by one switch, will be connected in parallel. Lamp loads controlled from two positions will have three-way switches. Lamps controlled from more than two positions will have thre-way and four-way switches installed appropriately. GFCI circuits will be wired as specified--master-slave, bypass, or direct. Arc Fault Circuit Breakers will be used as specified. Duplex receptacle strings will be connected in parallel. All split-wired duplexes will have one single pole switch controlling the upper half of the receptacle whle the lower half remains energized.

Your chosen job career will allow you use the skills you have mastered as well as skills you need to re-learn for new job sites.

UNIT RESOURCES: Electrical blueprint, single pole switches, lamps, three way switches, four way switches, GFCI's, AFCI's, and device cover plates.

Internet Resource Links:

www.branchcircuits.com

www.electricservice.com

www.circuitbreakerpanel.com

www.undergroundelectricservices.com

www.abovegroundelectricservices.com

www.realelectricalcareers.com

STAGE ONE

GOALS AND STANDARDS:

1. **Student will be able to mount a steel outlet box, install a ground screw and connect a single ground wire or a multiple ground wire splice.**
2. **Student will be able to mount a plastic outlet box, terminate multiple ground wires to the device through a green ground cap and connect devices such as**

receptacles, switches, or lamps.
3. Students will be able to connect branch circuits fed from AFCI's and GFCI's.
4. Students should be able to explore the benefits of a chosen career with the potential for advancement.

ENDURING UNDERSTANDING: The most common wiring methods used in new one- and two-family dwellings are nonmetallic-sheathed cable (Type NM) and armored cable (Type AC). Cable wiring methods are less expensive to install than raceway systems and require less training for the installer.

ESSENTIAL QUESTIONS:

1. **How do you connect a duplex receptacle?**
2. **How do you connect a single pole in-line switch?**
3. **How do you connect a single pole end-of-line switch?**
4. **How do you connect a lamp lighting load?**
5. **How do you connect a rerceptacle string?**
6. **What is a GFCI?**
7. **What is an AFCI?**
8. **How do you bypass a GFCI?**
9. **How do you connect branch circuits fed through AFCI?**
10. **How do you work to achieve an admirable electrical career?**

KNOWLEDGE AND SKILLS: Certain general rules and considerations apply to all wiring methods, including the components and equipment used in the installation. Knowledge and skills are the basic components of all careers.

STAGE TWO

PERFORMANCE TASKS: Making reference to an approved blueprint, students will connect receptacles, switches, and lighting loads to complete the final phase of wiring.

9.3 – Career & Technical Education (CTE)

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PATHWAY: SCIENCE & MATHEMATICS CAREER PATHWAY (ST-SM)

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CRP2. Apply appropriate academic and technical skills.
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Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

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CRP10. Plan education and career paths aligned to personal goals.
Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

CRP11. Use technology to enhance productivity.
Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in

acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

OTHER EVIDENCE: Using the appropriate wiring procedure ground all terminations inside the steel outlet box. During the final phase, plastic boxes will have the appropriate device ground.

STAGE THREE

LEARNING PLAN: Students complete the final phase of a job consisting of a number of operations individually taught and now being applied as a job on an employable task that began as a rough-in wiring event having mounted outlet boxes and terminated ground circuits that now are energized devices in the finished wiring scheme.

Unit 4 Name: FINAL PHASE WIRING: CONNECTING APPLIANCES/CAREERS/ SECTION 2

Time Frame: 5 WEEKS

Author: Industrial Technology Committee

UNIT

Subject: **Industrial Technology**

Country: **USA**

Course/Grade: **Electrical/Grade 10-12**

State/Group: **NJ**

School: **Egg Harbor Township High school**

UNIT SUMMARY: Many of your appliances will operate on 110v/220vac. Direct connected dishwashers will require lockouts/tagout devices in the circuit breaker panel. Most appliances work with two voltage circuits, a power circuit supplied by 220 volts ac and a control circuit powered by 110 volt ac. Washer machine units should be connected as required in the local municipality. 4-wire clothes dryer must be wired into a single receptacle. Disconnects for HVAC units are mounted within the required distance from the outdoor unit. Indoor units will require 110 volt condensate line, 110v/220vac for air handler and emergency heat panel. Hot water heater will require a 110v/220vac line. Baseboard heaters should have single pole line thermostats for temperature control.

When wiring appliances with metal cases, properly connected ground circuits should be your very first concern. Hard wired appliances may require circuit breaker lockouts which fit over the circuit breaker in the circuit breaker panel. This lockout device guarantees the unit will not be accidentally energized.

UNIT RESOURCES: Four Burner Range, Dishwasher, Baseboard Heating, Heating Ventilation & Air Conditioning Unit, Hot Water Heater, Washer/Dryer Unit.

Internet Resource Links:

www.thermostats.com

www.HVAC.com

www.GFCI.com

www.AFCI.com

www.appliancecircuits.com

www.cabinetgrounds.com

www.electricallockouts.com

STAGE ONE

GOALS AND STANDARDS:

1. **Student will be able to connect thermostat control for HVAC units.**
2. **Student will be able to install and connect a 220vac electric dryer receptacle.**
3. **Student will be able to connect a GFCI receptacle where required for a washer machine.**
4. **Student will be able to connect a 110vac/220vac electric supply line and disconnect for a 14SEER, R410, HVAC Unit.**
5. **Student will be able to connect 220 vac baseboard heating units.**
6. **Student will be able to connect a 220 vac range receptacle.**
7. **Student will be able to connect a 220 volt line into the hot water heater.**

ENDURING UNDERSTANDING:

Electric heating equipment, air-conditioning equipment, electric water heaters, electric clothes dryers, and electric cooking appliances, account for the largest loads in a dwelling.

ESSENTIAL QUESTIONS:

1. **What is a 220 volt ac line?**
2. **What is a 110 volt ac line?**
3. **What is a thermostat?**
4. **What is a Ground Fault Circuit Interrupter?**
5. **What is a baseboard heating unit?**
6. **What is a hot water heater?**
7. **What is an electric range?**
8. **Explain the term, "Career Objective"?**
9. **Explain the term, "Career Fault"?**

KNOWLEDGE AND SKILLS: When central heating and air conditioning are combined in the same system, a separate branch circuit is provided for the indoor unit (evaporator with air-handler) and outdoor unit (condenser).

STAGE TWO

PERFORMANCE TASKS: On a rotating basis, students will be able to connect a 110v/220vac receptacle supply lines through a double pole residential circuit breaker to power individual appliances.

Research the reasons that cause people to change careers.

CAREER CLUSTER®

By the end of Grade 12, Career and Technical Education Program completers will be able to:

CAREER CLUSTER•: SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS (ST)

9.3.ST.1 Apply engineering skills in a project that requires project management, process control and quality assurance.

9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.

9.3.ST.3 Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.

9.3.ST.4 Understand the nature and scope of the Science, Technology, Engineering & Mathematics Career Cluster and the role of STEM in society and the economy.

9.3.ST.5 Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways.

9.3.ST.6 Demonstrate technical skills needed in a chosen STEM field.

PATHWAY: ENGINEERING & TECHNOLOGY CAREER PATHWAY (ST-ET)

9.3.ST-ET.1 Use STEM concepts and processes to solve problems involving design and/or production.

9.3.ST-ET.2 Display and communicate STEM information.

9.3.ST-ET.3 Apply processes and concepts for the use of technological tools in STEM.

9.3.ST-ET.4 Apply the elements of the design process.

9.3.ST-ET.5 Apply the knowledge learned in STEM to solve problems.

9.3.ST-ET.6 Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.

9.3.ST-SM.1 Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.

9.3.ST-SM.2 Apply science and mathematics concepts to the development of plans,

processes and projects that address real world problems.

Using the appropriate wiring procedure ground all terminations inside the steel outlet box.

9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

Career Ready Practices

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP3. Attend to personal health and financial well-being.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP10. Plan education and career paths aligned to personal goals.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence.

CRP1. **Act as a responsible and contributing citizen and employee**
Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

CRP2. Apply appropriate academic and technical skills.
Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract

concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

CRP3. Attend to personal health and financial well-being.
Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.

CRP4. Communicate clearly and effectively and with reason.
Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

CRP5. Consider the environmental, social and economic impacts of decisions.
Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

CRP6. Demonstrate creativity and innovation.
Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

CRP7. Employ valid and reliable research strategies.
Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

CRP9. Model integrity, ethical leadership and effective management.
Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.

CRP10. Plan education and career paths aligned to personal goals.
Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

CRP11. Use technology to enhance productivity.
Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

CRP12. Work productively in teams while using cultural global competence.
Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

OTHER EVIDENCE: Using line voltage thermostats is the most common approach for controlling electric baseboard heaters. Single pole thermostats are used with 120 volt units and double pole thermostats are used with 208/240 volt units.

STAGE THREE

LEARNING PLAN: Assign student teams to a working appliance that has to be connected and made to operate. Have them do a lockout tagout on the circuit breaker line.

Curriculum Resources - Differentiated Instruction

Special Education Interventions in General Education

Visual Supports
Extended time to complete tests and assignments
Graphic Organizers
Mnemonic tricks to improve memory
Study guides
Use agenda book for assignments
Provide a posted daily schedule
Use of classroom behavior management system
Use prompts and model directions
Use task analysis to break down activities and lessons into each individual step needed to complete the task
Use concrete examples to teach concepts
Have student repeat/rephrase written directions
Heterogeneous grouping

Resources:

Do to Learn:
http://www.do2learn.com/

Sen Teacher:
http://www.senteacher.org/

Intervention Central:
http://www.interventioncentral.org/

Learning Ally:
https://www.learningally.org/

English Language Learners Interventions in Regular Education

Resources:

FABRIC - Learning Paradigm for ELLs (NJDOE)
www.nj.gov/education/bilingual/pd/**fabric**/**fabric**.pdf

Guide to Teaching ELL Students
http://www.colorincolorado.org/new-teaching-ells

Edutopia - Supporting English Language Learners
https://www.edutopia.org/blog/strategies-and-resources-supporting-ell-todd-finley

Reading Rockets
http://www.readingrockets.org/reading-topics/english-language-learners

Gifted and Talented Interventions in Regular Education
Resources:

Who are Gifted and Talented Students
http://www.npr.org/sections/ed/2015/09/28/443193523/who-are-the-gifted-and-talented-and-what-do-they-need

Hoagies Gifted Education Page
http://www.hoagiesgifted.org/programs.htm

21st Century Learning
Resources:

Partnership for 21st Century Learning
http://www.p21.org/

Career Ready Practices (NJDOE)
http://www.nj.gov/education/cte/hl/CRP.pdf