Science, Technology, Engineering, Mathematics Career Cluster
Foundation of Electronics
Course Number 21.45200

Course Description:
This foundational course is designed for students who are interested in careers related to the design, production, analysis, repair, and operation of devices that use electronics. Students will study and apply using project based learning activities the fundamentals of electricity and electronic systems including the theory and operation of how the basic components function, how a variety circuits are connected, and how to design these circuits. The pre-requisite for this course is advisor approval.

Course Standard 1

STEM-FE-1
The following standard is included in all CTAE courses adopted for the Career Cluster/Pathways. Teachers should incorporate the elements of this standard into lesson plans during the course. The topics listed for each element of the standard may be addressed in differentiated instruction matching the content of each course. These elements may also be addressed with specific lessons from a variety of resources. This content is not to be treated as a unit or separate body of knowledge but rather integrated into class activities as applications of the concept.

Standard: Demonstrate employability skills required by business and industry.
The following elements should be integrated throughout the content of this course.
1.1 Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities.

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<thead>
<tr>
<th>Person-to-Person Etiquette</th>
<th>Telephone and Email Etiquette</th>
<th>Cell Phone and Internet Etiquette</th>
<th>Communicating At Work</th>
<th>Listening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interacting with Your Boss</td>
<td>Telephone Conversations</td>
<td>Using Blogs</td>
<td>Improving Communication Skills</td>
<td>Reasons, Benefits, and Barriers</td>
</tr>
<tr>
<td>Interacting with Subordinates</td>
<td>Barriers to Phone conversations</td>
<td>Using Social Media</td>
<td>Effective Oral Communication</td>
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<tr>
<td>Interacting with Coworkers</td>
<td>Making and Returning Calls</td>
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<td>Ways We Filter What We Hear</td>
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<tr>
<td>Interacting with Suppliers</td>
<td>Making Cold Calls</td>
<td>Effective Nonverbal Skills</td>
<td>Developing a Listening Attitude</td>
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<tr>
<td>Handling Conference Calls</td>
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<td>Effective Word Use</td>
<td>Show You Are Listening</td>
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<tr>
<td>Handling Unsolicited Calls</td>
<td></td>
<td>Giving and Receiving Feedback</td>
<td>Asking Questions</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nonverbal Communication</th>
<th>Written Communication</th>
<th>Speaking</th>
<th>Applications and Effective Résumés</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communicating Nonverbally</td>
<td>Writing Documents</td>
<td>Using Language Carefully</td>
<td>Completing a Job Application</td>
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<tr>
<td>Reading Body Language and mixed Messages</td>
<td>Constructive Criticism in Writing</td>
<td>One-on-One Conversations</td>
<td>Writing a Cover Letter</td>
</tr>
<tr>
<td>Matching Verbal and Nonverbal communication</td>
<td>Small Group Communication</td>
<td>Things to Include in a Résumé</td>
<td></td>
</tr>
</tbody>
</table>
1.2 Demonstrate creativity by asking challenging questions and applying innovative procedures and methods.

<table>
<thead>
<tr>
<th>Teamwork and Problem Solving</th>
<th>Meeting Etiquette</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thinking Creatively</td>
<td>Preparation and Participation in Meetings</td>
</tr>
<tr>
<td>Taking Risks</td>
<td>Conducting Two-Person or Large Group Meetings</td>
</tr>
<tr>
<td>Building Team Communication</td>
<td>Inviting and Introducing Speakers</td>
</tr>
</tbody>
</table>

1.3 Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations.

<table>
<thead>
<tr>
<th>Problem Solving</th>
<th>Customer Service</th>
<th>The Application Process</th>
<th>Interviewing Skills</th>
<th>Finding the Right Job</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transferable Job Skills</td>
<td>Gaining Trust and Interacting with Customers</td>
<td>Providing Information, Accuracy and Double Checking</td>
<td>Preparing for an Interview</td>
<td>Locating Jobs and Networking</td>
</tr>
<tr>
<td>Becoming a Problem Solver</td>
<td>Learning and Giving Customers What They Want</td>
<td>Online Application Process</td>
<td>Questions to Ask in an Interview</td>
<td>Job Shopping Online</td>
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<tr>
<td>Identifying a Problem</td>
<td>Keeping Customers Coming Back</td>
<td>Following Up After Submitting an Application</td>
<td>Things to Include in a Career Portfolio</td>
<td>Job Search Websites</td>
</tr>
<tr>
<td>Becoming a Critical Thinker</td>
<td>Seeing the Customer’s Point</td>
<td>Effective Résumés: Traits Employers are Seeking</td>
<td>Participation in Job Fairs</td>
<td></td>
</tr>
<tr>
<td>Managing</td>
<td>Selling Yourself and the Company</td>
<td>Matching Your Talents to a Job</td>
<td>Considerations Before Taking a Job</td>
<td>Using Employment Agencies</td>
</tr>
<tr>
<td>Handling Customer Complaints</td>
<td>When a Résumé Should be Used</td>
<td></td>
<td></td>
<td>Staying Motivated to Search</td>
</tr>
<tr>
<td>Strategies for Customer Service</td>
<td></td>
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</tr>
</tbody>
</table>

1.4 Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity.

<table>
<thead>
<tr>
<th>Workplace Ethics</th>
<th>Personal Characteristics</th>
<th>Employer Expectations</th>
<th>Business Etiquette</th>
<th>Communicating at Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrating Good Work Ethic</td>
<td>Demonstrating a Good Attitude</td>
<td>Behaviors Employers Expect</td>
<td>Language and Behavior</td>
<td>Handling Anger</td>
</tr>
<tr>
<td>Behaving Appropriately</td>
<td>Gaining and Showing Respect</td>
<td>Objectionable Behaviors</td>
<td>Keeping Information Confidential</td>
<td>Dealing with Difficult Coworkers</td>
</tr>
<tr>
<td>Maintaining Honesty</td>
<td>Demonstrating Responsibility</td>
<td>Establishing Credibility</td>
<td>Avoiding Gossip</td>
<td>Dealing with a Difficult Boss</td>
</tr>
<tr>
<td>Playing Fair</td>
<td>Showing Dependability</td>
<td>Demonstrating Your Skills</td>
<td>Appropriate Work Email</td>
<td>Dealing with Difficult Customers</td>
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<tr>
<td>Using Ethical Language</td>
<td>Being Courteous</td>
<td>Building Work Relationships</td>
<td>Cell Phone Etiquette</td>
<td>Dealing with Conflict</td>
</tr>
<tr>
<td>Showing Responsibility</td>
<td>Gaining Coworkers’ Trust</td>
<td></td>
<td>Appropriate Work Texting</td>
<td></td>
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<tr>
<td>Reducing Harassment</td>
<td>Persevering</td>
<td></td>
<td>Understanding Copyright</td>
<td></td>
</tr>
<tr>
<td>Respecting Diversity</td>
<td>Handling Criticism</td>
<td></td>
<td>Social Networking</td>
<td></td>
</tr>
<tr>
<td>Making Truthfulness a Habit</td>
<td>Showing Professionalism</td>
<td></td>
<td></td>
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<tr>
<td>Leaving a Job Ethically</td>
<td></td>
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</tbody>
</table>

### 1.5 Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills.

<table>
<thead>
<tr>
<th>Expected Work Traits</th>
<th>Teamwork</th>
<th>Time Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrating</td>
<td>Teamwork Skills</td>
<td>Managing Time</td>
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<tr>
<td>Responsibility</td>
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<tr>
<td>Dealing with</td>
<td>Reasons Companies Use Teams</td>
<td>Putting First Things First</td>
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<tr>
<td>Information Overload</td>
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<tr>
<td>Transferable Job Skills</td>
<td>Decisions Teams Make</td>
<td>Juggling Many Priorities</td>
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<tr>
<td>Managing Change</td>
<td>Team Responsibilities</td>
<td>Overcoming Procrastination</td>
</tr>
<tr>
<td>Adopting a New Technology</td>
<td>Problems That Affect Teams</td>
<td>Organizing Workspace and Tasks</td>
</tr>
<tr>
<td>Expressing Yourself on a Team</td>
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<tr>
<td>Giving and Receiving Constructive Criticism</td>
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</tr>
</tbody>
</table>

### 1.6 Present a professional image through appearance, behavior and language.

<table>
<thead>
<tr>
<th>On-the-Job Etiquette</th>
<th>Person-to-Person Etiquette</th>
<th>Communication Etiquette</th>
<th>Presenting Yourself</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using Professional Manners</td>
<td>Meeting Business Acquaintances</td>
<td>Creating a Good Impression</td>
<td>Looking Professional</td>
</tr>
<tr>
<td>Introducing People</td>
<td>Meeting People for the First Time</td>
<td>Keeping Phone Calls Professional</td>
<td>Dressing for Success</td>
</tr>
<tr>
<td>Appropriate Dress</td>
<td>Showing Politeness</td>
<td>Proper Use of Work Email</td>
<td>Showing a Professional Attitude</td>
</tr>
<tr>
<td>Business Meal Functions</td>
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<td>Proper Use of Cell Phone</td>
<td>Using Good Posture</td>
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<tr>
<td>Behavior at Work Parties</td>
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<td>Proper Use in Texting</td>
<td>Presenting Yourself to Associates</td>
</tr>
<tr>
<td>Behavior at Conventions</td>
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</tr>
<tr>
<td>International Etiquette</td>
<td></td>
<td>Accepting Criticism</td>
<td></td>
</tr>
<tr>
<td>Cross-Cultural Etiquette</td>
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<td>Demonstrating Leadership</td>
<td></td>
</tr>
<tr>
<td>Working in a Cubicle</td>
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</tr>
</tbody>
</table>

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence L9-10RST 1-10 and L9-10WHST 1-10:

Georgia Standards of Excellence ELA/Literacy standards have been written specifically for technical subjects and have been adopted as part of the official standards for all CTAE courses. Additional Georgia Standards of Excellence ELA/Literacy standards for Speaking and Listening are listed in the foundational course standards below.
Course Standard 2

STEM-FE-2
Develop an understanding of engineering and electronics and describe the principal fields of engineering and electronic specializations (ex. aeronautical, automotive, chemical, civil, industrial, and mechanical, computer software, electrical, and biomedical) and identify associated career tracks.

2.1 Explain a contemporary definition of engineering and electronics.
2.2 Identify education requirements for engineering and electronics occupations and locations where programs of study are available.
2.3 Match engineering and electronics job titles with qualifications and responsibilities.
2.4 Participate in activities related to career interests.
2.5 Explain how each engineering and electronic discipline will relate to a green environment and sustainability.

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

ELACC9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.

ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Course Standard 3

STEM-FE-3
Describe and follow safety, health and environmental standards related to Science, Technology, Engineering, and Math (STEM) workplaces.

3.1 Implement workplace and product safety standards such as OSHA, EPA, ISO, GMP, and UL. (STEM-ST3).
3.2 Accurately interpret safety signs, symbols, and labels (Hazardous Communications).
3.3 Demonstrate and incorporate safe laboratory procedures in lab, shop, and field environments.
3.4 Explain how the incorporation or lack of safety practices impact the economy and costs of safety in business and industry.
3.5 Identify, select, and use appropriate Personal Protective Equipment (PPE), follow work area organization procedures and follow Standard Operating Procedures (SOP) when preforming work.

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

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ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

SCSh2: Students will use standard safety practices for all classroom laboratory and field investigations.

a. Follow correct procedures for use of scientific apparatus.
b. Demonstrate appropriate technique in all laboratory situations.
c. Follow correct protocol for identifying and reporting safety problems and violations.
Course Standard 4

STEM-FE-4
Identify criteria of usage, care, and maintenance for tools and machines.
4.1 Identify, select and use appropriate tools and machines for specific tasks.
4.2 Demonstrate safe use of tools and machines.
4.3 Use precision tools and instruments to measure and convert units.
4.4 Utilize appropriate computer hardware and software to compose, analyze and synthesize data to document the design process.
4.5 Apply proper maintenance techniques for tools, machines, and hardware.

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence
ELACC9-10SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
SCSh5: Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.
   c. Recognize the relationship between accuracy and precision.
   d. Express appropriate numbers of significant figures for calculated data, using scientific notation where appropriate.
SCSh4: Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.
   c. Use technology to develop, test, and revise experimental or mathematical models.
SCSh2: Students will use standard safety practices for all classroom laboratory and field investigations.
   a. Follow correct procedures for use of scientific apparatus.
   b. Demonstrate appropriate technique in all laboratory situations.

Course Standard 5

STEM-FE-5
Introduce the history and development of electron theory.
5.1 Discuss the history of electron theory.
5.2 Identify the atom: protons, neutrons, and electrons.
5.3 Identify material conductivity/insulators.

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence
ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
SPS1: Students will investigate our current understanding of the atom.
   a. Examine the structure of the atom in terms of: proton, electron, and neutron locations.
SCSh7: Students will analyze how scientific knowledge is developed. Students will recognize that:
   b. Universal principles are discovered through observation and experimental verification.
   c. From time to time, major shifts occur in the scientific view of how the world works. More often, however, the changes that take place in the body of scientific knowledge are small modifications of prior knowledge. Major shifts in scientific views typically occur after the observation of a new phenomenon or an insightful interpretation of existing data by an individual or research group.
d. Hypotheses often cause scientists to develop new experiments that produce additional data.
e. Testing, revising, and occasionally rejecting new and old theories never ends.

**Course Standard 6**

**STEM–FE-6**

Identify electronic theories applicable to electronic processes.

6.1 Define Ohm’s law and formula component parts.
6.2 Define Kirchhoff’s law and component parts.
6.3 Define Watt’s law and component parts.
6.4 Design and analyze a simple circuit to determine the values of the various electronic component parts.
6.5 Demonstrate the use of metric prefixes and value conversions.

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

SP5: Students will evaluate relationships between electrical and magnetic forces.
   b. Determine the relationship among potential difference, current, and resistance in a direct current circuit.
   c. Determine equivalent resistances in series and parallel circuits.

**Course Standard 7**

**STEM-FE-7**

Introduce electronic components that comprise an electronic system.

7.1 Identify Resistor Color Code and component polarity.
7.2 Identify and describe various resistors, capacitors, transistors, coils, semiconductors, etc.
7.3 Discuss circuit design and construction.
7.4 Develop and evaluate a prototype device.

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

ELACC9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.

ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

SPS10: Students will investigate the properties of electricity and magnetism.
   b. Explain the flow of electrons in terms of:
      • alternating and direct current.
      • the relationship among voltage, resistance and current.
      • simple series and parallel circuits.
Course Standard 8

STEM-FE-8

Introduce the techniques and processes in electronics systems.

8.1 Explain and demonstrate basic soldering techniques.
8.2 Explain procedures for connecting circuit components.
8.3 Conduct laboratory experiments utilizing appropriate soldering techniques.
8.4 Evaluate prototype produced.

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.

ELACC9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.

ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Course Standard 9

STEM–FE-9

Understand the various measuring apparatuses appropriate to electronics systems.

9.1 Identify and demonstrate proper use of a multi-meter.
9.2 Identify and demonstrate proper use of an oscilloscope.
9.3 Discuss virtual computer simulation testing and how it is used in electronics.
9.4 Construct a continuity prototype device.

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.

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ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Course Standard 10

STEM-FE-10

Use appropriate technology to collect, record, manipulate, analyze, and report data.

10.1 Demonstrate the ability to recognize cause and effect when faced with projects or issues.
10.2 Recognize measurable attributes in units, objects, systems, and processes in assigned activities.
10.3 Organize data and the consequences of the problems or issues, and research the material placing it in manageable formats.
10.4 Attempt to predict the outcomes based on data collected in a project or experiment.
10.5 Defend one's position based on quality collection of facts and data supporting plans, processes, and/or projects.
10.6 Draw a conclusion when confronted with data or observations that focus on the observed plans, processes, or projects at hand.
10.7 Analyze change as a result of data differences and changing environmental values.
10.8 Use qualitative and quantitative skills to conduct a simple scientific inquiry and economic analysis; use the data to draw a conclusion based on the analysis.

10.9 Recognize the value of the reiterative process to improve data and to improve the design process.

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.

ELACC9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.

ELACC9-10SL3: Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.

ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

MCC9-12.S.ID.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

SCSh3: Students will identify and investigate problems scientifically.
  a. Suggest reasonable hypotheses for identified problems.
  b. Develop procedures for solving scientific problems.
  c. Collect, organize and record appropriate data.
  d. Graphically compare and analyze data points and/or summary statistics.
  e. Develop reasonable conclusions based on data collected.
  f. Evaluate whether conclusions are reasonable by reviewing the process and checking against other available information.

Course Standard 11

STEM–FE-11
Design a solution to an engineering and electronics problem applying math and science principles.

11.1 Apply science and mathematics concepts and principles to resolve plans, projects, processes, issues, or problems through methods of inquiry.

11.2 Use the protocols in science and mathematics to integrate solutions related to technical, electronic, or engineering activities using the content and concepts related to the situation or problems.

11.3 Explain the role of modeling and/or simulation in electricity and electronics.

11.4 Communicate and collaborate with others on inquiry or resolution of issues/problems in the global community.

11.5 Defend one’s solution based on quality collection of facts and data supporting plans, processes, and/or projects and communicate the solution both orally and written.

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.

ELACC9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.

ELACC9-10SL3: Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.

ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and
logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

**Standards for Mathematical Practice**

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

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

- Use data as evidence to support scientific arguments and claims in written or oral presentations.
- Participate in group discussions of scientific investigation and current scientific issues.

**SCSh8**: Students will understand important features of the process of scientific inquiry.

Students will apply the following to inquiry learning practices:

- Scientific investigators control the conditions of their experiments in order to produce valuable data.
- Scientific researchers are expected to critically assess the quality of data including possible sources of bias in their investigations’ hypotheses, observations, data analyses, and interpretations.
- Scientists use practices such as peer review and publication to reinforce the integrity of scientific activity and reporting.

**Course Standard 12**

**STEM–FE-12**

**Construct an electronic device as a culminating experience.**

- 12.1 Construct Series, Parallel and Series/Parallel circuits.
- 12.2 Simulate test circuits utilizing electronic software.
- 12.3 Design, construct, and test an electronic device from component parts.

**Support of CTAE Foundation Course Standards and Georgia Standards of Excellence**

**SPS10**: Students will investigate the properties of electricity and magnetism.

- Explain the flow of electrons in terms of: simple series and parallel circuits.

**Course Standard 13**

**STEM-FE-13**

**Explore how related career and technology student organizations are integral parts of career and technology education courses. Students will develop leadership, interpersonal, and problem-solving skills through participation in co-curricular activities associated with the Technology Student Association.**

- 13.1 Explain the goals, mission and objectives of CTSO’s.
- 13.2 Explore the impact and opportunities a student organization (TSA) can develop to bring business and education together in a positive working relationship through innovative leadership and career development programs.
- 13.3 Explore the local, state, and national opportunities available to students through participation in related student organization (TSA) including but not limited to conferences, competitions, community service, philanthropy, and other (TSA) activities.
- 13.4 Explain how participation in career and technology education student organizations can
promote lifelong responsibility for community service and professional development.

13.5 Demonstrate teamwork, leadership, interpersonal relations, and project management.

13.6 Through teamwork, apply the skills and abilities in requirements analysis and configuration control while working with plans, processes, and projects as assigned.

13.7 Through teamwork, use the skills required in project management to track and assess the progress of a plan, process, or project as assigned.

13.8 Through teamwork, apply the skills in quality assurance as well as those in process management and development for appropriate applications of systems integration techniques to an assigned project.

13.9 Effectively use project management techniques (e.g., teamwork, appropriate time management practices, effective organizational skills, conduct analysis of cost, resources, and production capacity, and quality practices with continuous improvement).

13.10 Understand and demonstrate proper work ethics when working with plans, processes, and projects as assigned.

**Support of CTAE Foundation Course Standards and Georgia Standards of Excellence**

**ELACC9-10SL1:** Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively.

**ELACC9-10SL4:** Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.