Science, Technology, Engineering and Mathematics Career Cluster
Digital Electronics
Course Number 21.45400

Course Description:

As the third course in the Electronics pathway, the Digital Electronics course provides students with opportunities to apply prior learning in electronics to the digital world in which they live. Students use applications of mathematics and science to predict the success of an engineered solution and complete hands-on activities with tools, materials, and processes as they develop functional devices and working prototypes aided by computer simulations. Students will create artifacts that demonstrate application of competencies in technical, academic, cognitive, and personal skills through daily work, team work, and homework, formative and informative assessments. Assessments will demonstrate how students meet mastery for each standard. Students may be assessed through daily habits, homework, in-class assignments, examinations and project evaluation.

Course Standard 1

STEM-DE-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.

Person-to-Person Etiquette	Telephone and Email Etiquette	Cell Phone and Internet Etiquette	Communicating At Work	Listening
Interacting with Your Boss	Telephone Conversations	Using Blogs	Improving Communication Skills	Reasons, Benefits, and Barriers
Interacting with Subordinates	Barriers to Phone conversations	Using Social Media	Effective Oral Communication	Listening Strategies
Interacting with Co-workers	Making and Returning Calls		Effective Written Communication	Ways We Filter What We Hear
Interacting with Suppliers	Making Cold Calls		Effective Nonverbal Skills	Developing a Listening Attitude
	Handling Conference Calls		Effective Word Use	Show You Are Listening
	Handling Unsolicited Calls		Giving and Receiving Feedback	Asking Questions
				Obtaining Feedback
				Getting Others to Listen

Nonverbal Communication	Written Communication	Speaking	Applications and Effective Résumés
Communicating Nonverbally	Writing Documents	Using Language Carefully	Completing a Job Application
Reading Body Language and mixed Messages	Constructive Criticism in Writing	One-on-One Conversations	Writing a Cover Letter
Matching Verbal and Nonverbal communication		Small Group Communication	Things to Include in a Résumé
Improving Nonverbal Indicators		Large Group Communication	Selling Yourself in a Résumé
Nonverbal Feedback		Making Speeches	Terms to Use in a Résumé
Showing Confidence Nonverbally		Involving the Audience	Describing Your Job Strengths
Showing Assertiveness		Answering Questions	Organizing Your Résumé
		Visual and Media Aids	Writing an Electronic Résumé
		Errors in Presentation	Dressing Up Your Résumé

1.2   Demonstrate creativity by asking challenging questions and applying innovative procedures and methods.

Teamwork and Problem Solving	Meeting Etiquette
Thinking Creatively	Preparation and Participation in Meetings
Taking Risks	Conducting Two-Person or Large Group Meetings
Building Team Communication	Inviting and Introducing Speakers
	Facilitating Discussions and Closing
	Preparing Visual Aids
	Virtual Meetings

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

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

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

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

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.

Expected Work Traits	Teamwork	Time Management
Demonstrating Responsibility	Teamwork Skills	Managing Time
Dealing with Information Overload	Reasons Companies Use Teams	Putting First Things First
Transferable Job Skills	Decisions Teams Make	Juggling Many Priorities
Managing Change	Team Responsibilities	Overcoming Procrastination
Adopting a New Technology	Problems That Affect Teams	Organizing Workspace and Tasks
	Expressing Yourself on a Team	Staying Organized
	Giving and Receiving Constructive Criticism	Finding More Time
		Managing Projects
		Prioritizing Personal and Work Life

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

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

Cross-Cultural Etiquette			
Working in a Cubicle			

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.

Course Standard 2

STEM-DE-2
Analyze fields of engineering and electronic specializations (i.e. aeronautical, automotive, chemical, civil, industrial, and mechanical, computer software, electrical, and biomedical) and identify associated career tracks.
   2.1   Design a project that conveys information about electronic specialization.
   2.2   Participate in activities related to career interests.
   2.3   Relate each engineering and electronic discipline to a green environment and sustainability situation.
   2.4   Develop solutions to an ethical issue in engineering and electronic specialization.

Course Standard 3

STEM-DE-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 Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), International Organization for Standardization (ISO), Good Manufacturing Practice (GMP), and Underwriters Laboratories (UL).
   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 performing work.

Course Standard 4

STEM-DE-4
Analyze characteristics of digital and analog systems.
   4.1   Differentiate between digital and analog systems through the use a visual meter (Oscilloscope).
   4.2   Identify numbering systems used in digital electronics and calculate conversion between systems.
   4.3   Apply Boolean concepts to simplification processes using DeMorgan laws for transformation or Karmaugh Maps (K Maps).

Course Standard 5

STEM-DE-5
Demonstrate knowledge of logic gates (IF, Then, Else).
  5.1 Classify and compare names, symbols, truth tables and Boolean Expression for the following logic gates: AND, OR, NOT, NOR, NAND (Negated AND or NOT AND), exclusive OR, and exclusive NOR gates.
  5.2 Classify and compare names, symbols, truth tables and Boolean Expression for the logic gates that include practical Transistor-Transistor Logic (TTL) and Complementary Metal Oxide Semiconductor (CMOS).
  5.3 Classify and compare names, symbols, truth tables and Boolean Expression for the Institute of Electrical and Electronics Engineers (IEEE) logic symbols.

Course Standard 6

STEM-DE-6
Compare and contrast the use of several commonly used digital codes, including the differences between conversion of decimal numbers and letters to code.
  6.1 Define and create a compare and contrast chart for 8421 Binary-Coded Decimal (BCD), Excess-3, and American Standard Code for Information Interchange (ASCII) codes.
  6.2 Identify and discuss applications for encoders/decoders.
  6.3 Construct a technical sketch or draw a display and/or multiplexers.
  6.4 Determine the best code for specific industry problems.

Course Standard 7

STEM-DE-7
Use truth tables and interpret waveforms to determine flip-flop modes of operation and outputs.
  7.1 Technically sketch or draw RS, D, and JK flip-flop circuits.
  7.2 Technically sketch or draw Integrated Circuits (IC) Latches and Schmitt Triggers.
  7.3 Create a project that demonstrates knowledge of operation and outputs.

Course Standard 8

STEM-DE-8
Analyze the output for a variety of counters based on a series of inputs.
  8.1 Estimate output and then measure by ripple, synchronous, down, and self-stopping counters. Compile information into a table and present that suggests the most accurate method.
  8.2 Graph and analyze the data for frequency dividers.
  8.3 Interpret shift registers through critiquing the results.
  8.4 Create counter circuits to solve real world scenarios.

Course Standard 9

STEM-DE-9
Analyze block-style logic diagrams.
  9.1 Technically sketch or draw parallel adder circuits.
  9.2 Technically sketch or draw parallel subtractor circuits.
  9.3 Create a project that states the advantages and disadvantages of parallel added and subtracted circuits and includes binary multiplication.

Course Standard 10

STEM-DE-10

Investigate common memory and storage devices used in a microcomputer system.

10.1 Assess the value for common memory, microcomputer function block diagram and storage devices used in a microcomputer system.

10.2 Create a project that demonstrates the traits of Random Access Memory (RAM), Static RAM, Read-Only Memory (ROM), Programmable Read-Only Memory (PROMs), Arithmetic Logic Unit (ALU), and registers, control and data path.

10.3 Discuss non-volatile read/write in a project.

10.4 Compare various types of portable or temporary memory devices.

Course Standard 11

STEM-DE-11

Create a digital project that displays mastery of the standards involved with electronics.

11.1 Present the constructed projects from the standards in a digital portfolio through pictures, drawings, data and analysis.

11.2 Make recommendations for improvements on each project based on experiences gained from the process.