

Energy Career Cluster
Foundations of Energy Technologies
Course Number 49.53700

Course Description:

Foundations of Energy Technologies explores the relationship between force, work, energy, and power. Students study the characteristics, availability, conversion, control, transmission, and storage of energy and power, as well as examine and apply the principles of electrical, fluid, and mechanical power. Students research renewable, non-renewable, and inexhaustible resources and conservation efforts. Using their course-acquired skills, students will further understand the many careers that exist in energy and related technologies.

Course Standard 1

ENGR-FET-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	Constructive	One-on-One	Writing a Cover Letter

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and mixed Messages	Criticism in Writing	Conversations	
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	Gaining and	Objectionable	Keeping Information	Dealing with

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Appropriately	Showing Respect	Behaviors	Confidential	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

ENGR-FET-2. Students will determine and analyze the relationships between energy, work, power, and force.

- a. Define terms that describe the use and measurement of energy.
- b. State and explain the significance of Newton's Law.
- c. Describe how energy is measured and determine the amount of work that can be accomplished with that particular energy in a given situation.
- d. Outline the difference between energy and power.
- e. Identify the three common forms of power.

ACADEMIC STANDARDS:

SP1. Students will analyze the relationships between force, mass, gravity, and the motion of objects.

SP3. Students will evaluate the forms and transformations of energy.

MM1P1. Students will solve problems (using appropriate technology).

MM1P4. Students will make connections among mathematical ideas and to other disciplines.

MM1A1. Students will explore and interpret the characteristics of functions, using graphs, tables, and simple algebraic techniques.

MM1A3. Students will solve simple equations.

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

SCSh4. Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

SCSh5. Students will demonstrate the computation and estimation skills data and developing reasonable scientific explanations.

MM3P1. Students will solve problems (using appropriate technology).

MM3P2. Students will reason and evaluate mathematical arguments.

MM3P3. Students will communicate mathematically.

MM3P4. Students will make connections among mathematical ideas and to other disciplines.

ELAALRC2. The student participates in discussions related to curricular learning in all subject areas.

ELAALRC3. The student acquires new vocabulary in each content area and uses it correctly.

Course Standard 3

ENGR-FET-3. Students will identify the six simple machines and explain how each machine changes the value for force and distance during work.

- a. Identify the six simple machines.

- b. Describe what is meant by mechanical advantage and explain how it is determined by using force and distance in the work equation.
- c. Identify two ways of determining the mechanical advantage of a machine.
- d. Solve problems involving simple machines, input and output forces, and mechanical advantage.
- e. Describe the relationship of force and speed when either is changed by the advantage of a mechanical device.

ACADEMIC STANDARDS:

SP1. Students will analyze the relationships between force, mass, gravity, and the motion of objects

SP3. Students will evaluate the forms and transformations of energy.

MM1P1. Students will solve problems (using appropriate technology).

MM1P4. Students will make connections among mathematical ideas and to other disciplines.

MM1A1. Students will explore and interpret the characteristics of functions, using graphs, tables, and simple algebraic techniques.

MM1A3. Students will solve simple equations.

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

SCSh3. Students will identify and investigate problems scientifically.

SCSh4. Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

SCSh5. Students will demonstrate the computation and estimation skills data and developing reasonable scientific explanations.

MM3P1. Students will solve problems (using appropriate technology).

MM3P3. Students will communicate mathematically.

MM3P4. Students will make connections among mathematical ideas and to other disciplines.

MM3P5. Students will represent mathematics in multiple ways.

ELAALRC2. The student participates in discussions related to curricular learning in all subject areas.

ELAALRC3. The student acquires new vocabulary in each content area and uses it correctly.

ELAALRC4. The student establishes a context for information acquired by reading across subject areas.

Course Standard 4

ENGR-FET-4. Students will differentiate between fluid power systems and apply the laws that govern.

- a. Apply characteristics of Boyle's Law, Charles Law, and Archimedes principle.
- b. Explain what is meant by fluid power.

- c. Explain how the volume of a gas varies with the changes in pressure and temperature.
- d. Describe how a fluid is able to transfer force as well as change the relationship between force and distance or speed.
- e. Solve mathematical problems involving changes in pressure, temperature, and volume in fluid power systems.

ACADEMIC STANDARDS:

SP3. Students will evaluate the forms and transformations of energy.

SPS5. Students will compare and contrast the phases of matter as they relate to atomic and molecular motion.

MM1P1. Students will solve problems (using appropriate technology).

MM1P4. Students will make connections among mathematical ideas and to other disciplines.

MM1A1. Students will explore and interpret the characteristics of functions, using graphs, tables, and simple algebraic techniques.

MM1A3. Students will solve simple equations.

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

SCSh3. Students will identify and investigate problems scientifically.

SCSh5. Students will demonstrate the computation and estimation skills data and developing reasonable scientific explanations.

SCSh6. Students will communicate scientific investigations and information clearly.

MM3P1. Students will solve problems (using appropriate technology).

MM3P3. Students will communicate mathematically.

MM3P4. Students will make connections among mathematical ideas and to other disciplines.

ELAALRC3. The student acquires new vocabulary in each content area and uses it correctly.

ELAALRC4. The student establishes a context for information acquired by reading across subject areas.

Course Standard 5

ENGR-FET-5. Students will differentiate between AC and DC circuits and apply Ohm's Law to Series, Parallel, and Series/Parallel circuits as well as discuss Kirchoff's Law.

- a. Differentiate between accelerating current and direct current.
- b. Explain differences between series, parallel, and series-parallel circuits.
- c. Define voltage, current, and resistance.
- d. Calculate current, voltage, and resistance in a circuit by using Ohm's Law.
- e. Recognize and apply when Kirchoff's Law is demonstrated.

ACADEMIC STANDARDS:

SP5. Students will evaluate relationships between electrical and magnetic forces.

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

MM1P1. Students will solve problems (using appropriate technology).

MM1P4. Students will make connections among mathematical ideas and to other Disciplines

MM1A1. Students will explore and interpret the characteristics of functions, using graphs, tables, and simple algebraic techniques.

MM1A3. Students will solve simple equations.

MM2G2. Students will define and apply sine, cosine, and tangent ratios to right triangles.

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

SCSh3. Students will identify and investigate problems scientifically.

SCSh4. Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

SCSh5. Students will demonstrate the computation and estimation skills data and developing reasonable scientific explanations.

MM3P1. Students will solve problems (using appropriate technology).

MM3P3. Students will communicate mathematically.

MM3P4. Students will make connections among mathematical ideas and to other disciplines.

ELAALRC2. The student participates in discussions related to curricular learning in all subject areas.

ELAALRC3. The student acquires new vocabulary in each content area and uses it correctly.

ELAALRC4. The student establishes a context for information acquired by reading across subject areas.

Course Standard 6

ENGR-FET-6. Students will describe and demonstrate the basic components of a small engine and explain the difference between a four-stroke and two-stroke engine.

- a. Describe the four-stroke engine operation and explain the purpose of each stroke.
- b. Explain the concept of valve timing.
- c. Compare the lubrication system in a four-cycle engine to the system of a two-cycle engine.
- d. Describe the two-stroke engine operation and explain the principles of two-cycle operation.
- e. List the advantages and disadvantages of two-cycle and four-cycle engines.
- f. Disassemble and reassemble a basic small engine.

ACADEMIC STANDARDS:

- SCSh2. Students will use standard safety practices for all classroom laboratory and field investigations.
- SP1. Students will analyze the relationships between force, mass, gravity, and the motion of objects.
- SP3. Students will evaluate the forms and transformations of energy.
- MM1P1. Students will solve problems (using appropriate technology).
- MM1P4. Students will make connections among mathematical ideas and to other disciplines.
- MM1A1. Students will explore and interpret the characteristics of functions, using graphs, tables, and simple algebraic techniques.
- MM1A3. Students will solve simple equations.
- MM2G2. Students will define and apply sine, cosine, and tangent ratios to right triangles.
- SCSh2. Students will use standard safety practices for all classroom laboratory and field investigations.
- SCSh4. Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.
- SCSh5. Students will demonstrate the computation and estimation skills data and developing reasonable scientific explanations.
- MM3P1. Students will solve problems (using appropriate technology).
- MM3P2. Students will reason and evaluate mathematical arguments.
- MM3P3. Students will communicate mathematically.
- MM3P4. Students will make connections among mathematical ideas and to other disciplines.
- MM3P5. Students will represent mathematics in multiple ways.
- ELAALRC2. The student participates in discussions related to curricular learning in all subject areas.
- ELAALRC3. The student acquires new vocabulary in each content area and uses it correctly.
- ELAALRC4. The student establishes a context for information acquired by reading across subject areas.

Course Standard 7

ENGR-FET-7. Identify and describe careers and the entry requirements for occupations in the Energy Industry.

- a. Describe entry-level careers available in energy generation, transmission, distribution and the education/experience requirements for entry into those positions, along with career development and advancement opportunities from those positions.
- b. Identify entry-level careers available in business and corporate support functions of the energy industry; describes the education/experience requirements for entry into those positions, and career advancement opportunities from those positions.
- c. Describe general wage/salary, benefits, and other advantages of careers in the energy industry.
- d. Explain the educational pathways available to gain training necessary for entry into energy careers at the post-secondary level.

Course Standard 8

ENGR-FET-8. Students 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.

- a. Explain the goals, mission and objectives of CTSO organizations.
- b. 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.
- c. 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.
- d. Explain how participation in career and technology education student organizations can promote lifelong responsibility for community service and professional development.
- e. Demonstrate teamwork, leadership, interpersonal relations, and project management.
- f. Through teamwork, apply the skills and abilities in requirements analysis and configuration control while working with plans, processes, and projects as assigned.
- g. Through teamwork, use the skills required in project management to track and assess the progress of a plan, process, or project as assigned.
- h. 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
- i. 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).
- j. 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.