Georgia Department of Education

Science, Technology, Engineering, Mathematics Career Cluster
Foundations of Engineering and Technology
Course Number 21.42500

Course Description:
The Foundations of Engineering and Technology is the introductory course for the Engineering and Technology Education pathways. This STEM driven course provides the students with an overview of engineering and technology including the different methods used in the engineering design process developing fundamental technology and engineering literacy. Students will demonstrate the skills and knowledge they have learned through various project based activities while using an engineering design process to successfully master the "E" in STEM. The pre-requisite for this course is advisor approval.

Course Standard 1

STEM-FET-1

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.
1.2 Demonstrate creativity with multiple approaches to ask challenging questions resulting in innovative procedures, methods, and products.
1.3 Exhibit critical thinking and problem solving skills to locate, analyze, and apply information in career planning and employment situations.
1.4 Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity.
1.5 Apply the appropriate skill sets to be productive in a changing, technological, and diverse workplace to be able to work independently, interpret data, and apply team work skills.
1.6 Present a professional image through appearance, behavior, and language.

Support of CTAE Foundation Course Standards and Common Core GPS and Georgia Performance Standards

L9-10RST 1-10 and **L9-10WHST 1-10:** Common Core 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 Common Core ELA/Literacy standards for Speaking and Listening are listed in the foundational course standards below.

Course Standard 2

STEM-FET-2

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

2.1 Explain a contemporary definition of engineering.
2.2 Identify education requirements for engineering occupations and locations where programs of study are available.

2.3 Match engineering job titles with qualifications and responsibilities.
2.4 Participate in activities related to career interests.
2.5 Explain how each engineering discipline will relate to a green environment and sustainability.

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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-FET-3

Identify the history of technology and engineering and its impact on society in the past, present, and future.

3.1 Describe the history and development of engineering.
3.2 Describe the social, economic, and environmental impacts of a technological process, product, or system.
3.3 Explain the influence of technology on history and the shaping of contemporary issues.
3.4 Describe the relationship between the STEM cluster and society.
3.5 Evaluate the impact of science and society based on products and processes used in the real world for technological development.
3.6 Understand STEM knowledge and skills to analyze and suggest solutions to human societal problems.
3.7 Apply STEM knowledge and skills through hands-on research and lab experiments that are focused upon recreating the inventions and social solutions that were realized in the past, present, and possible future.
3.8 Identify key people who have influenced technological change.
3.9 Describe the impact of governmental and political systems on technological innovations.
3.10 Demonstrate ethical and professional engineering behavior in the development and use of technology.

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Course Standard 4

STEM-FET-4

Demonstrate and follow safety, health, and environmental standards related to the Science, Technology, Engineering, and Math (STEM) workplaces.

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

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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 5

STEM-FET-5

Identify criteria of usage, care, and maintenance for tools and machines.

5.1 Identify, select, and use appropriate tools and machines for specific tasks.
5.2 Demonstrate safe use of tools and machines.
5.3 Use precision tools and instruments to measure and convert units.
5.4 Utilize appropriate computer hardware and software to compose, analyze and synthesize data to document the design process.
5.5 Apply proper maintenance techniques for tools, machines, and hardware.

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Course Standard 6

STEM-FET-6

Apply fundamental principles of the engineering design process.

6.1 Understand and apply the engineering design process through project based learning activities.
6.2 Conduct technical research to develop possible solutions to a stated engineering problem.
6.3 Refine a design by using technical sketches, prototypes and modeling to ensure quality, efficiency, and productivity of the final product.
6.4 Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process (optimization and iterations) in order to check for proper design and note areas where improvements are needed.
6.5 Apply engineering economics and optimal design techniques to a design solution.
6.6 Record and organize observations and test data during design evaluation.
6.7 Finalize solutions and communicate observation, processes, and results of the entire design process, using verbal, graphic, quantitative, qualitative, virtual, and physical means.

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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.

Course Standard 7

STEM-FET-7

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

7.1 Demonstrate the ability to recognize cause and effect when faced with projects or issues.
7.2 Recognize measurable attributes in units, objects, systems, and processes in assigned activities.
7.3 Organize data and the consequences of the problems or issues, and research the material placing it in manageable formats.
7.4 Attempt to predict the outcomes based on data collected in a project or experiment.

7.5 Defend one's position based on quality collection of facts and data supporting plans, processes, and/or projects.
7.6 Draw a conclusion when confronted with data or observations that focus on the observed plans, processes, or projects at hand.
7.7 Analyze change as a result of data differences and changing environmental values.
7.8 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.
7.9 Recognize the value of the reiterative process to improve date and to improve the design process.

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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 8

STEM-FET-8

Students design a solution to an engineering problem applying math and science principles.

8.1 Apply science and mathematics concepts and principles to resolve plans, projects, processes, issues, or problems through methods of inquiry.
8.2 Use the protocols in science and mathematics to integrate solutions related to technical or engineering activities using the content and concepts related to the situation or problems.
8.3 Explain the role of modeling and/or simulation in science and engineering.
8.4 Communicate and collaborate with others on inquiry or resolution of issues/problems in the global community.
8.5 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.

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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.

c. Use data as evidence to support scientific arguments and claims in written or oral presentations.
d. 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:

a. Scientific investigators control the conditions of their experiments in order to produce valuable data.
b. 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.
c. Scientists use practices such as peer review and publication to reinforce the integrity of scientific activity and reporting.

Course Standard 9

STEM-FET-9

Demonstrate the application of STEM in the real world.

9.1 Summarize and differentiate the uses of engineering and various technologies for STEM fields such as Aerospace, Automotive, Medical, Biotechnology, Energy and Power, Information and Communication, Automation and Robotics, Transportation, Manufacturing, and Construction.

Support of CTAE Foundation Course Standards and Common Core GPS and Georgia Performance Standards

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-FET-10

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.

10.1 Explain the goals, mission and objectives of CTSO organizations.
10.2 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.
10.3 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.
10.4 Explain how participation in career and technology education student organizations can promote lifelong responsibility for community service and professional development.
10.5 Demonstrate teamwork, leadership, interpersonal relations, and project management.
10.6 Through teamwork, apply the skills and abilities in requirements analysis and configuration control while working with plans, processes, and projects as assigned.
10.7 Through teamwork, use the skills required in project management to track and assess the progress of a plan, process, or project as assigned.
10.8 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
10.9 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).
10.10 Understand and demonstrate proper work ethics when working with plans, processes, and projects as assigned.

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