



# ENERGY CAREER ACADEMY FRAMEWORK GRADE 10

**THEME:** Building STEM/Engineering Design Skills and Exploring Careers & the World of Work

**CREDENTIALS:** SkillsUSA Career Essentials: Fundamentals Micro-credential

## MODULE 1: STEM/Engineering Design

**Curriculum Source:** Siemens Ingenuity for Life (Project-based Learning)

- Teacher's guide and required software is available free of charge at [siemensdesign.tomwhitestem.com](http://siemensdesign.tomwhitestem.com)
- Cost for equipment (\$6,000; one-time purchase), and Consumable Kit (\$2,700 for class of 24 students; annual purchase) available at [studica.com](http://studica.com)

**Total Instructional Time:** A full year course, but should be slightly adjusted to under 100 hours to accommodate the other modules for grade 10

### Engineering Design Process

- 1) Create and maintain an Engineering Notebook for daily reflections, research, and prototype creation documentation.
- 2) Apply the design and problem-solving process as an iterative process incorporating sciences, mathematics, and engineering to optimally convert resources to meet a stated objective.
- 3) Communicate solutions utilizing technical writing skills including correct spelling, proper grammar, and dependent vocabulary.
- 4) Assume and carry out a role in the smooth running of a team working toward the solution of a problem. Assemble a quantitative plan for successful completion of the project.
- 5) Assume responsibility for leadership roles and responsibility for actions, decisions, products, and policies in the governance of a project.
- 6) Evaluate the cost/benefit of resources necessary for the project.

### Sketching

- 1) Create sketches utilizing basic shapes such as lines, circles, and ellipses.
- 2) Communicate ideas to a group through the use of sketches and other documentation.
- 3) Apply isometric and orthographic sketches and add clarity to design.
- 4) Create necessary sketches to communicate basic ideas during the design process.

### 3-D Solid Modeling/Fabrication and 3-D Printing

- 1) Apply geometric relationships between lines and shapes to create a mathematical database to describe design ideas.
- 2) Create solid models utilizing concepts of Parametric Modeling.
- 3) Analyze models for appropriate engineering design features needed.
- 4) Develop strategies for the creation of solid models for the rapid creation of design solutions.
- 5) Apply the concepts of digital prototyping to accelerate the time frame between ideation and completed project.
- 6) Access, generate, process, and transfer information using appropriate technologies.

- 7) Design and create a model using additive manufacturing technology sometimes called a rapid prototyping system.
- 8) Apply new principles of more rapid and less costly development and deployment of new materials. Utilize rapid prototyping/additive manufacturing to create highly complex parts designed in a CAD system.

### Renderings/Working Drawings/Design Presentations

- 1) Create renderings to communicate design ideas and engineering principles to the general public. Generate an image from a model utilizing light, texture, and shading to create a proposed final appearance of a product.
- 2) Apply rendering techniques to create presentations of design for a non-technical audience.

### Assembly Modeling/Documentation/Exploded Assemblies/Bill of Materials

- 1) Conduct model documentation as the process of recording details such as size, material composition, and instructions for assembling, installation and servicing, analysis, development process that describes a model for the purpose of communication of ideas.
- 2) Create a bill of materials to communicate materials and other information about a design.
- 3) Reverse Engineering and Engineering Features.
- 4) Apply the principles of design for manufacturing enabling the efficient and effective production of products.
- 5) Apply the green principles of design for eventual disassembly and resource recovery.
- 6) Investigate activities that a business conducts with the intention of making a discovery that can either lead to the development of new products or procedures, or to the improvement of existing products or procedures. Know the new approaches of rapid development and deployment that saves time and is more efficient.
- 7) Disassemble a product into its parts. Utilize precision measurement to create sketches, drawings and models of the product and identify the basic processes, systems, designs, and materials used in the manufacturing of the product.

### Reverse Engineering/Engineering Features

- 1) Apply the principles of design for manufacturing enabling the efficient and effective production of products.
- 2) Apply the green principles of design for eventual disassembly and resource recovery.
- 3) Investigate activities that a business conducts with the intention of making a discovery that can either lead to the development of new products or procedures, or to improvement of existing products or procedures. Know the new approaches of rapid development and deployment that saves time and is more efficient.
- 4) Dissassemble a product into its parts, utilize precision measurement to create sketches, drawings and models of the product, and identify the basic processes, systems, designs, and materials used in the manufacturing of the product.

### Simple Machines

- 1) Utilize mathematical analysis, scientific inquiry, and engineering design to develop solutions to open ended problems.
- 2) Access, generate, process, and transfer information using appropriate technologies.
- 3) Apply the design process in the design of a mechanical system.

- 4) Read and analyze detailed descriptions of machinery and provide a concise summary for documentation purposes.
- 5) Assign mathematical relationships to analyze mechanical advantage.
- 6) Apply problem solving methodology in the creation of unique solutions to mechanical motion problems. Assign mathematical relationships to analyze mechanical advantage.
- 7) Apply problem solving methodology in the creation of unique solutions to mechanical motion problems.

### Mechanical Systems

- 1) Utilize mathematical analysis, scientific inquiry, and engineering design to develop solutions to open ended problems.
- 2) Access, generate, process, and transfer information using appropriate technologies.
- 3) Apply the design process in the design of a mechanical system.
- 4) Read and analyze detailed descriptions of machinery and provide a concise summary for documentation purposes.
- 5) Assign mathematical relationships to schematics to apply forces.
- 6) Apply problem solving methodology in the creation of unique solutions to mechanical motion problems. Apply the design process in the design of a mechanical system.
- 7) Design a system of elements that manage power to accomplish a task that involves defined movement. Read and analyze detailed descriptions of machinery and provide a concise summary for documentation purposes.
- 8) Apply problem solving methodology in the creation of unique solutions to mechanical motion problems.

### Structures/Forces

- 1) Create models that are mathematical or physical systems set up to obey certain specified conditions whose behavior is used to understand study or evaluate a design or system.
- 2) Conduct model analysis using FEA and simulations as a detailed examination of the elements, structure, or behavior of a physical system under certain imposed conditions
- 3) Assign mathematical relationships to schematics to apply forces.
- 4) Conduct a systematic study of the relationship of the material, members, and the construction of the structure when loaded to determine the resulting deflections and forces..
- 5) Apply knowledge of stress and strain to the design of a problem solution.

## MODULE 2: Career Strategies

**Curriculum Source:** CSMlearn available at [www.csmlearn.com](http://www.csmlearn.com)

Contact Mirriam Goldberg at [miriam@csmlearn.org](mailto:miriam@csmlearn.org)

**Total instructional and testing time:** 5-7 hours

- 1) Differentiate between careers and jobs.
- 2) Explain the types of assets gained through a career.
- 3) Identify opportunities to build skills and bring a growth mindset to daily work tasks.
- 4) Detail the education ecosystem as well as tools for finding and choosing colleges and programs with good track records.

- 5) Recognize the key characteristics of effective careers based on what matters most to the individual.

### **MODULE 3: Career Essentials: Fundamentals Course & Credential**

**Curriculum Source:** SkillsUSA

- Available at [careeressentials.org](http://careeressentials.org)
- Cost is \$30 for students when teacher or students SkillsUSA members; \$60 for nonmembers

**Total instructional and testing time:** 30 hours

Covers a variety of employability skills, see [careeressentials.org](http://careeressentials.org) for reference.