CONTENT STANDARD 1.0: LAB ORGANIZATION AND SAFETY PROCEDURES

Performance Standard 1.1: General Lab Safety Rules and Procedures

1.1.1 Describe general shop safety rules and procedures.
1.1.2 Demonstrate knowledge of OSHA and its role in workplace safety.
1.1.3 Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities (i.e., personal protection equipment – PPE).
1.1.4 Operate lab equipment according to safety guidelines.
1.1.5 Identify and use proper lifting procedures and proper use of support equipment.
1.1.6 Utilize proper ventilation procedures for working within the lab/shop area.
1.1.7 Identify marked safety areas and safety signage.
1.1.8 Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment.
1.1.9 Identify the location and use of eye wash stations.
1.1.10 Identify the location of the posted evacuation routes.
1.1.11 Identify and wear appropriate clothing for lab/shop activities.
1.1.12 Secure hair and jewelry for lab/shop activities.
1.1.13 Understand knowledge of the safety aspects of low and high voltage circuits.
1.1.14 Locate and interpret safety data sheets (SDS).
1.1.15 Perform housekeeping duties.
1.1.16 Follow verbal instructions to complete work assignments.
1.1.17 Follow written instructions to complete work assignments.

Performance Standard 1.2: Hand Tools

1.2.1 Identify hand tools and their appropriate usage.
1.2.2 Identify standards and metric designation.
1.2.3 Demonstrate the proper techniques when using hand tools.
1.2.4 Demonstrate safe handling and use of appropriate tools.
1.2.5 Identify proper cleaning, storage and maintenance of tools.

Performance Standard 1.3: Power Tools and Equipment

1.3.1 Identify power tools and their appropriate usage.
1.3.2 Identify equipment and their appropriate usage.
1.3.3 Demonstrate the proper techniques when using power tools and equipment.
1.3.4 Demonstrate safe handling and use of appropriate power tools and equipment.
1.3.5 Identify proper cleaning, storage and maintenance of power tools and equipment.

CONTENT STANDARD 2.0: IMPACT OF ENGINEERING

Performance Standard 2.1: Engineering History

2.1.1 Define engineering.
2.1.2 Identify engineering achievements throughout history.
2.1.3 Research how historical period and regional style have influenced engineering design.
Performance Standard 2.2: Engineering Careers

- 2.2.1 Investigate engineering careers, training, and associated opportunities.
- 2.2.2 Describe the difference between engineering disciplines and job functions.
- 2.2.3 Explore career opportunities and list the educational requirements for a given engineering field.
- 2.2.4 Describe the importance of engineering teams.
- 2.2.5 Differentiate the careers associated with associates degrees, bachelor degrees, and master plus degrees.

Performance Standard 2.3: Ethics in Engineering

- 2.3.1 Knowledge of current professional engineering codes of ethics.
- 2.3.2 Knowledge of ethical engineering issues.
- 2.3.3 Apply and explain how ethical and technical issues contribute to an engineering disaster.
- 2.3.4 Describe how ethics influence the engineering process.

CONTENT STANDARD 3.0: ENGINEERING DESIGN PROCESS

Performance Standard 3.1: Design Process

- 3.1.1 Identify and understand the common elements of a design process, including define the problem, generate concepts, develop a solution, develop a design proposal, construct and test a prototype, refine the design, evaluate a solution and communicate the processes and results.
- 3.1.2 Apply the steps of the design process to solve a design problem.
- 3.1.3 Describe how social, environmental, and financial constraints influence the design process.
- 3.1.4 Diagram the lifecycle of a product.

CONTENT STANDARD 4.0: ENGINEERING DOCUMENTATION

Performance Standard 4.1: Freehand Technical Sketching Techniques

- 4.1.1 Develop design ideas using freehand sketching.
- 4.1.2 Identify the six primary orthographic views.
- 4.1.3 Create pictorial and multi-view sketches.
- 4.1.4 Utilize the alphabet of lines (i.e., styles and weights) and/or line conventions.
- 4.1.5 Legibly annotate sketches.

Performance Standard 4.2: Measuring and Scaling Techniques

- 4.2.1 Identify industry standard units of measure.
- 4.2.2 Convert between industry standard units of measure.
- 4.2.3 Determine appropriate engineering and metric scales.
- 4.2.4 Measure speed, distance, object size, area, mass, volume, and temperature.
- 4.2.5 Determine and apply the equivalence between fractions and decimals.
- 4.2.6 Demonstrate proper use of precision measuring tools.
Performance Standard 4.3: Engineering Documentation Procedures

4.3.1 Demonstrate record keeping procedures and communication in engineering.
4.3.2 Identify the importance of proprietary documentation in engineering.
4.3.3 Understand the copyright and patent process.
4.3.4 Illustrate project management timelines.
4.3.5 Create a written technical report.

Performance Standard 4.4: Technical Drawings

4.4.1 Interpret basic elements of a technical drawing (i.e., title block information, dimensions, and line types).
4.4.2 Produce drawings from sketches.
4.4.3 Identify industry standard symbols.
4.4.4 Describe and construct various types of drawings (i.e., part, assembly, pictorial, orthographic, isometric, and schematic) using proper symbols.
4.4.5 Construct drawings utilizing metric and customary (i.e., SAE and Imperial) measurement systems.
4.4.6 Arrange dimensions and annotations using appropriate standards (i.e., ANSI and ISO).
4.4.7 Construct bill of materials or schedule.

Performance Standard 4.5: Modeling Techniques

4.5.1 Identify the areas of modeling (i.e., physical, conceptual, and mathematical).
4.5.2 Create a scale model or working prototype.
4.5.3 Evaluate a scale model or a working prototype.

CONTENT STANDARD 5.0: MATERIAL PROPERTIES

Performance Standards 5.1: Material Properties and Science

5.1.1 Identify the major material families used in manufacturing.
5.1.2 Differentiate between the various types of material properties and their applications.
5.1.3 Discuss the impact of material usage on the environment.
5.1.4 Explain how cost in production is affected by the availability, quality, and quantity of resources.
5.1.5 Differentiate among raw material standard stock and finished products.

Performance Standards 5.2: Materials Strength

5.2.1 Describe the various forms of stress (i.e., compression, tension, torque, and shear).
5.2.2 Recognize and describe a stress strain curve.
5.2.3 Create free body diagrams of objects, identifying all forces acting on the object.
5.2.4 Differentiate between scalar and vector quantities.
5.2.5 Understand magnitude, direction, and sense of a vector.
5.2.6 Understand moment and torque forces.

CONTENT STANDARD 6.0: FUNDAMENTAL POWER SYSTEMS AND ENERGY PRINCIPLES
<table>
<thead>
<tr>
<th>Performance Standard 6.1: Power Systems and Energy Forms</th>
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</thead>
<tbody>
<tr>
<td>6.1.1 Define terms used in power systems (e.g., power, work, horsepower, watts, etc.).</td>
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<tr>
<td>6.1.2 Identify the basic power systems.</td>
</tr>
<tr>
<td>6.1.3 List the basic elements of power systems.</td>
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<td>6.1.4 Summarize the advantages and disadvantages of various forms of power.</td>
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<td>6.1.5 Calculate the efficiency of power systems and conversion devices.</td>
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<tr>
<td>6.1.6 Define energy.</td>
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<tr>
<td>6.1.7 Define potential energy and kinetic energy.</td>
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<tr>
<td>6.1.8 Identify forms of potential energy and kinetic energy.</td>
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<tr>
<td>6.1.9 Categorize types of energy into major forms such as, thermal, radiant, nuclear, chemical, electrical, mechanical, and fluid.</td>
</tr>
<tr>
<td>6.1.10 Identify units used to measure energy.</td>
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<tr>
<td>6.1.11 Analyze and apply data and measurements to solve problems and interpret documents.</td>
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<tr>
<td>6.1.12 Calculate unit conversions between common energy measurements.</td>
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<td>6.1.13 Demonstrate an energy conversion device.</td>
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<th>Performance Standard 6.2: Basic Mechanical Systems</th>
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<tr>
<td>6.2.1 Distinguish between the six simple machines, their attributes and components.</td>
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<tr>
<td>6.2.2 Measure forces and distances related to mechanisms.</td>
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<tr>
<td>6.2.3 Determine efficiency in a mechanical system.</td>
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<td>6.2.4 Calculate mechanical advantage and drive ratios of mechanisms.</td>
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<tr>
<td>6.2.5 Calculate work, power, torque and/or moments.</td>
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<tr>
<td>6.2.6 Design, construct, and test various basic mechanical systems.</td>
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<table>
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<th>Performance Standard 6.3: Energy Sources and Applications</th>
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<tbody>
<tr>
<td>6.3.1 Identify and categorize energy sources as nonrenewable, renewable, or inexhaustible.</td>
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<tr>
<td>6.3.2 Define the possible types of power conversion.</td>
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<tr>
<td>6.3.3 Measure circuit values using a multimeter.</td>
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<tr>
<td>6.3.4 Calculate power in a system that converts energy from electrical to mechanical.</td>
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<tr>
<td>6.3.5 Determine efficiency of a system that converts an electrical input to a mechanical output.</td>
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<tr>
<td>6.3.6 Compute values of current, resistance, and voltage using Ohm’s law.</td>
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<tr>
<td>6.3.7 Solve series and parallel circuits using basic laws of electricity including Kirchhoff’s laws.</td>
</tr>
<tr>
<td>6.3.8 Test and apply the relationship between voltage, current, and resistance relating to a photovoltaic cell and a hydrogen fuel cell.</td>
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<tr>
<th>Performance Standard 6.4: Machine Control Systems</th>
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<tbody>
<tr>
<td>6.4.1 Create detailed operational flowcharts.</td>
</tr>
<tr>
<td>6.4.2 Create system control programs (i.e., sequential, logic)</td>
</tr>
<tr>
<td>6.4.3 Select appropriate input and output devices based on system specifications and constraints.</td>
</tr>
</tbody>
</table>
6.4.4 Differentiate between the characteristics of digital and analog devices.
6.4.5 Compare and contrast open and closed loop systems.
6.4.6 Design and create a control system based on specifications and constraints.

**Performance Standard 6.5: Basic Fluid Systems**

6.5.1 Define fluid systems (e.g., hydraulic, pneumatic, vacuum, etc.).
6.5.2 Identify and define the components of fluid systems.
6.5.3 Compare and contrast hydraulic and pneumatic systems.
6.5.4 Identify the advantages and disadvantages of using fluid power systems.
6.5.5 Explain the difference between gauge pressure and absolute pressure.
6.5.6 Discuss the safety concerns of working with liquids and gases under pressure.
6.5.7 Calculate mechanical advantage using Pascal’s law.
6.5.8 Calculate values in a pneumatic system using the ideal gas laws.

**CONTENT STANDARD 7.0: STATISTICS AND KINEMATIC PRINCIPLES**

**Performance Standard 7.1: Statistics**

7.1.1 Define statistical terminology.
7.1.2 Create a histogram to illustrate frequency distribution.
7.1.3 Calculate the central tendency of a data array to include mean, median, and mode.
7.1.4 Calculate data variation to include range, standard deviation, and variance.

**Performance Standard 7.2: Kinematic Principles**

7.2.1 Define kinematic terminology.
7.2.2 Calculate distance, displacement, speed, velocity, and acceleration based on specific data.
7.2.3 Calculate acceleration due to gravity based on data from a free-fall device.