

Pre-Engineering Program Standards Criticality Survey 2015

1. Personal Qualities and People Skills				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
Demonstrate a positive work ethic by coming to work every day on time, a willingness to take direction, and motivation to accomplish the task at hand.	0	2	14	2.88
Demonstrate integrity by abiding by workplace policies and laws and demonstrating honesty and reliability.	0	3	14	2.82
Demonstrate teamwork skills by contributing to the success of the team, assisting others, and requesting help when needed.	0	7	10	2.59
Demonstrate positive self-representation skills by dressing appropriately and using language and manners suitable for the workplace.	2	6	9	2.41
Demonstrate diversity awareness by working well with all customers and co-workers.	0	10	7	2.41
Demonstrate conflict-resolution skills by negotiating diplomatic solutions to interpersonal and workplace issues.	3	8	6	2.18
Demonstrate creativity and resourcefulness by contributing new ideas and working with initiative.	2	10	5	2.18
Answered				17
Skipped				0

2. Professional Knowledge and Skills				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
Demonstrate effective speaking and listening skills by communicating effectively with customers and employees and following directions.	1	8	8	2.41
Demonstrate effective reading and writing skills by reading and interpreting workplace documents and writing clearly.	2	5	10	2.47
Demonstrate critical-thinking and problem-solving skills by analyzing and resolving problems that arise in completing assigned tasks.	1	6	10	2.53
Demonstrate healthy behaviors and safety skills by following safety guidelines and managing personal health.	0	3	14	2.82
Demonstrate understanding of workplace organizations, systems, and climates by identifying "big picture" issues and fulfilling the mission of the workplace.	5	8	4	1.94
Demonstrate lifelong-learning skills by continually acquiring new industry-related information and improving professional skills.	2	5	10	2.47
Demonstrate job acquisition and advancement skills by preparing to apply for a job and seeking promotion.	5	9	3	1.88
Demonstrate time, task, and resource management skills by organizing and implementing a productive plan of work.	5	2	10	2.29
Demonstrate mathematical skills by using mathematical reasoning to accomplish tasks.	2	10	5	2.18
Demonstrate customer service skills by identifying and addressing the needs of all customers and providing helpful, courteous, and knowledgeable service.	7	2	8	2.06
Answered				17
Skipped				0

3. Technology Knowledge and Skills				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
Demonstrate proficiency with job-specific technologies by selecting and safely using technological resources to accomplish work responsibilities in a productive manner.	1	7	9	2.47
Demonstrate proficiency with information technology by using computers, file management techniques, and software/programs effectively.	1	6	10	2.53
Demonstrate proper Internet use and security by using the Internet appropriately for work.	1	12	4	2.18
Demonstrate proficiency with telecommunications by selecting and using appropriate devices, services, and applications.	6	8	3	1.82
Answered				17
Skipped				0

CONTENT STANDARD 1.0: LAB ORGANIZATION AND SAFETY PROCEDURES				
Performance Standard 1.1: General Lab Safety Rules and Procedures				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
1.1.1 Describe general shop safety rules and procedures.	1	7	8	2.44
1.1.2 Demonstrate knowledge of OSHA and its role in workplace safety.	1	12	3	2.13
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	2	13	2.75
1.1.4 Operate lab equipment according to safety guidelines.	2	3	11	2.56
1.1.5 Identify and use proper lifting procedures and proper use of support equipment.	3	9	4	2.06
1.1.6 Utilize proper ventilation procedures for working within the lab/shop area.	2	10	4	2.13
1.1.7 Identify marked safety areas and safety signage.	2	10	4	2.13

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.	2	9	5	2.19
1.1.9	Identify the location and use of eye wash stations.	2	8	6	2.25
1.1.10	Identify the location of the posted evacuation routes.	2	7	5	2.21
1.1.11	Identify and wear appropriate clothing for lab/shop activities.	2	5	9	2.44
1.1.12	Secure hair and jewelry for lab/shop activities.	2	7	7	2.31
1.1.13	Understand knowledge of the safety aspects of low and high voltage circuits.	1	5	10	2.56
1.1.14	Locate and interpret material safety data sheets (MSDS).	3	10	3	2.00
1.1.15	Perform housekeeping duties.	3	11	2	1.94
1.1.16	Follow verbal instructions to complete work assignments.	0	7	9	2.56
1.1.17	Follow written instructions to complete work assignments.	1	7	8	2.44
				Answered	16
				Skipped	1

Performance Standard 1.2: Hand Tools					
	Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
1.2.1	Identify hand tools and their appropriate usage.	4	8	4	2.00
1.2.2	Identify standards and metric designation.	4	7	5	2.06
1.2.3	Demonstrate the proper techniques when using hand tools.	4	6	6	2.13
1.2.4	Demonstrate safe handling and use of appropriate tools.	3	4	9	2.38
1.2.5	Identify proper cleaning, storage and maintenance of tools.	8	5	3	1.69
				Answered	16
				Skipped	1

Performance Standard 1.3: Power Tools and Equipment				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
1.3.1 Identify power tools and their appropriate usage.	5	6	5	2.00
1.3.2 Identify equipment and their appropriate usage.	5	6	5	2.00
1.3.3 Demonstrate the proper techniques when using power tools and equipment.	4	4	8	2.25
1.3.4 Demonstrate safe handling and use of appropriate power tools and equipment.	3	5	8	2.31
1.3.5 Identify proper cleaning, storage and maintenance of power tools and equipment.	7	5	4	1.81
Answered				16
Skipped				1

CONTENT STANDARD 2.0: IMPACT OF ENGINEERING				
Performance Standard 2.1: Engineering History				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
2.1.1 Define engineering.	8	7	1	1.56
2.1.2 Identify engineering achievements throughout history.	11	4	1	1.38
2.1.3 Research how historical period and regional style have influenced engineering design.	13	3	0	1.19
2.1.4 Investigate the evolution of a product.	11	4	1	1.38
Answered				16
Skipped				1

Performance Standard 2.2: Engineering Careers				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
2.2.1 Investigate engineering careers, training, and associated opportunities.	5	8	3	1.88
2.2.2 Describe the difference between engineering disciplines and job functions.	6	9	1	1.69
2.2.3 Explore career opportunities and list the educational requirements for a given engineering field.	4	11	1	1.81
2.2.4 Describe the importance of engineering teams.	5	10	1	1.75
2.2.5 Differentiate the careers associated with associates degrees, bachelor degrees, and master plus degrees.	3	10	3	2.00
			Answered	16
			Skipped	1

Performance Standard 2.3: Ethics in Engineering				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
2.3.1 Knowledge of current professional engineering codes of ethics.	4	9	3	1.94
2.3.2 Knowledge of ethical engineering issues.	4	11	1	1.81
2.3.3 Apply and explain how ethical and technical issues contribute to an engineering disaster.	2	11	3	2.06
2.3.4 Describe how ethics influence the engineering process.	2	12	2	2.00
			Answered	16
			Skipped	1

CONTENT STANDARD 3.0: ENGINEERING DESIGN PROCESS				
Performance Standard 3.1: Design Process				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
3.1.1 Understand the common elements of a design process: 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	5	8	2.31
3.1.2 Apply the steps of the design process to solve a design problem.	2	4	9	2.47
3.1.3 Describe how social, environmental, and financial constraints influence the design process.	4	7	5	2.06
3.1.4 Diagram the lifecycle of a product.	7	6	3	1.75
Answered				16
Skipped				1

CONTENT STANDARD 4.0: ENGINEERING DOCUMENTATION				
Performance Standard 4.1: Freehand Technical Sketching Techniques				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
4.1.1 Develop design ideas using freehand sketching.	5	7	4	1.94
4.1.2 Identify the six primary orthographic views	10	3	3	1.56
4.1.3 Create pictorial and multi-view sketches.	6	5	5	1.94
4.1.4 Utilize the alphabet of lines (i.e., styles and weights) and/or line conventions.	8	6	2	1.63
4.1.5 Legibly annotate sketches.	4	9	3	1.94
Answered				16
Skipped				1

Performance Standard 4.2: Measuring and Scaling Techniques				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
4.2.1 Identify industry standard units of measure.	3	4	9	2.38
4.2.2 Convert between industry standard units of measure.	2	5	9	2.44
4.2.3 Determine appropriate engineering and metric scales.	3	6	7	2.25
4.2.4 Measure speed, distance, object size, area, mass, volume, and temperature.	2	5	9	2.44
4.2.5 Determine and apply the equivalence between fractions and decimals.	3	5	8	2.31
4.2.6 Demonstrate proper use of precision measuring tools.	5	3	8	2.19
Answered				16
Skipped				1

Performance Standard 4.3: Engineering Documentation Procedures				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
4.3.1 Demonstrate record keeping procedures and communication in engineering.	4	8	4	2.00
4.3.2 Identify the importance of proprietary documentation in engineering.	5	8	3	1.88
4.3.3 Understand the copyright and patent process.	9	5	2	1.56
4.3.4 Illustrate project management timelines.	4	9	3	1.94
4.3.5 Create a written technical report.	4	8	3	1.93
Answered				16
Skipped				1

Performance Standard 4.4: Technical Drawings				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
4.4.1 Demonstrate record keeping procedures and communication in engineering.	4	9	3	1.94
4.4.2 Produce drawings from sketches.	6	6	4	1.88
4.4.3 Identify industry standard symbols.	3	7	5	2.13
4.4.4 Describe and construct various types of drawings (i.e., part, assembly, pictorial, orthographic, isometric, and schematic) using proper symbols.	6	4	6	2.00
4.4.5 Construct drawings utilizing metric and customary (i.e., SAE and Imperial) measurement systems.	6	6	4	1.88
4.4.6 Arrange dimensions and annotations using appropriate standards (i.e., ANSI and ISO).	9	4	3	1.63
4.4.7 Construct bill of materials or schedule.	7	5	4	1.81
Answered				16
Skipped				1

Performance Standard 4.5: Modeling Techniques				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
4.5.1 Identify the areas of modeling (i.e., physical, conceptual, and mathematical).	8	5	3	1.69
4.5.2 Create a scale model or working prototype.	8	5	3	1.69
4.5.3 Evaluate a scale model or a working prototype.	8	5	3	1.69
Answered				16
Skipped				1

CONTENT STANDARD 5.0: MATERIAL PROPERTIES				
Performance Standard 5.1: Material Properties and Science				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
5.1.1 Identify the major material families used in manufacturing.	8	5	3	1.69
5.1.2 Differentiate between the various types of material properties and their applications.	5	8	3	1.88
5.1.3 Discuss the impact of material usage on the environment.	8	7	1	1.56
5.1.4 Explain how cost in production is affected by the availability, quality, and quantity of resources.	5	9	2	1.81
5.1.5 Differentiate among raw material standard stock and finished products.	7	6	3	1.75
Answered				16
Skipped				1

Performance Standard 5.2: Materials Strength				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
5.2.1 Describe the various forms of stress (i.e., compression, tension, torque, and shear).	4	6	6	2.13
5.2.2 Recognize and describe a stress strain curve.	6	4	6	2.00
5.2.3 Create free body diagrams of objects, identifying all forces acting on the object.	8	4	4	1.75
5.2.4 Differentiate between scalar and vector quantities.	6	6	4	1.88
5.2.5 Understand magnitude, direction, and sense of a vector.	4	8	4	2.00
5.2.6 Understand moment and torque forces.	5	6	5	2.00
Answered				16
Skipped				1

CONTENT STANDARD 6.0: FUNDAMENTAL POWER SYSTEMS AND ENERGY PRINCIPLES

Performance Standard 6.1: Power Systems and Energy Forms

	Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
6.1.1	Define terms used in power systems (e.g., power, work, horsepower, watts, etc.).	3	8	5	2.13
6.1.2	Identify the basic power systems.	3	8	5	2.13
6.1.3	List the basic elements of power systems.	3	9	4	2.06
6.1.4	Summarize the advantages and disadvantages of various forms of power.	2	10	4	2.13
6.1.5	Calculate the efficiency of power systems and conversion devices.	7	5	4	1.81
6.1.6	Define energy.	2	10	4	2.13
6.1.7	Define potential energy and kinetic energy.	2	10	4	2.13
6.1.8	Identify forms of potential energy and kinetic energy.	3	8	5	2.13
6.1.9	Analyze and apply data and measurements to solve problems and interpret documents.	4	8	4	2.00
6.1.10	Calculate unit conversions between common energy measurements.	4	7	5	2.06
6.1.11	Demonstrate an energy conversion device.	8	5	3	1.69
Answered					16
Skipped					1

Performance Standard 6.2: Basic Mechanical Systems

	Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
6.2.1	Distinguish between the six simple machines, their attributes and components.	6	5	5	1.94
6.2.2	Measure forces and distances related to mechanisms.	7	3	6	1.94
6.2.3	Determine efficiency in a mechanical system.	5	6	5	2.00
6.2.4	Calculate mechanical advantage and drive ratios of mechanisms.	6	3	7	2.06
6.2.5	Calculate work, power, torque and/or moments.	6	5	5	1.94
6.2.6	Design, construct, and test various basic mechanical systems.	6	4	6	2.00
Answered					16
Skipped					1

Performance Standard 6.3: Energy Sources and Applications				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
6.3.1 Identify and categorize energy sources as nonrenewable, renewable, or inexhaustible.	8	5	3	1.69
6.3.2 Define the possible types of power conversion.	5	8	3	1.88
6.3.3 Measure circuit values using a multimeter.	4	3	9	2.31
6.3.4 Calculate power in a system that converts energy from electrical to mechanical.	5	6	5	2.00
6.3.5 Determine efficiency of a system that converts an electrical input to a mechanical output.	5	9	2	1.81
6.3.6 Compute values of current, resistance, and voltage using Ohm's law.	4	5	7	2.19
6.3.7 Solve series and parallel circuits using basic laws of electricity including Kirchhoff's laws.	4	5	7	2.19
6.3.8 Test and apply the relationship between voltage, current, and resistance relating to a photovoltaic cell and a hydrogen fuel cell.	8	1	6	1.87
Answered				16
Skipped				1

Performance Standard 6.4: Machine and Control Systems				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
6.4.1 Create detailed operational flowcharts.	4	8	4	2.00
6.4.2 Create system control programs (i.e., sequential, logic).	6	6	4	1.88
6.4.3 Select appropriate input and output devices based on system specifications and constraints.	2	10	4	2.13
6.4.4 Differentiate between the characteristics of digital and analog devices.	3	6	6	2.20
6.4.5 Compare and contrast open and closed loop systems.	4	5	7	2.19
6.4.6 Design and create a control system based on specifications and constraints.	6	5	5	1.94
Answered				16
Skipped				1

Performance Standard 6.5: Basic Fluid Systems				
Answer Choices	Nice to Know	Need to Know	Critical to Know	Rating Average
6.5.1 Define fluid systems (e.g., hydraulic, pneumatic, vacuum, etc.).	4	7	5	2.06
6.5.2 Identify and define the components of fluid systems.	5	6	5	2.00
6.5.3 Compare and contrast hydraulic and pneumatic systems.	8	3	4	1.73
6.5.4 Identify the advantages and disadvantages of using fluid power systems.	5	7	4	1.94
6.5.5 Explain the difference between gauge pressure and absolute pressure.	3	4	9	2.38
6.5.6 Discuss the safety concerns of working with liquids and gases under pressure.	3	1	12	2.56
6.5.7 Calculate mechanical advantage using Pascal's law.	7	5	4	1.81
6.5.8 Calculate values in a pneumatic system using the ideal gas laws.	8	4	4	1.75
Answered				16
Skipped				1

CONTENT STANDARD 7.0: STATISTICS AND KINEMATIC PRINCIPLES				
Performance Standard 7.1: Statistics				
Answer Choices	Nice to	Need to	Critical	Rating
7.1.1 Define statistical terminology.	6	7	2	1.73
7.1.2 Create a histogram to illustrate frequency distribution.	9	4	2	1.53
7.1.3 Calculate the central tendency of a data array to include mean, median, and mode.	8	5	2	1.60
7.1.4 Calculate data variation to include range, standard deviation, and variance.	8	5	2	1.60
Answered				15
Skipped				2

Performance Standard 7.2: Kinematic Principles					
	Answer Choices	Nice to	Need to	Critical	Rating
7.2.1	Define kinematic terminology.	9	4	2	1.53
7.2.2	Calculate distance, displacement, speed, velocity, and acceleration based on specific data.	5	6	4	1.93
7.2.3	Calculate acceleration due to gravity based on data from a free-fall device.	9	3	3	1.60
Answered					15
Skipped					2