

**National Content Standards  
K-12 Engineering/Engineering Technology  
American Society of Engineering Education (ASEE)  
(Review Draft Content, January 2007)**

**Technology Education Program Checklist**

<b>ASEE K-12 Engineering/Engineering Technology Standards Statements</b>			
<b>1) Engineering Design Declarative Statements</b>			
<b>Standard One: Students will develop an understanding of engineering design. Students will understand the basic concept of:</b>			
1D1: Design and how to conduct experiments, as well as to analyze and interpret data as it relates to engineering design.			
1D2: Designing, testing, and building a system, component, or process to meet desired needs within realistic constraints.			
1D3: Identifying and formulating engineering problems as they relate to engineering design.			
1D4: Applying iteration as a part of an engineering design process.			
1D5: Suggesting and evaluating alternative solutions.			
1D6: Optimizing a solution as it relates to engineering design.			
1D7: Problem solving and that not all problems can be solved with engineering design.			
1D8: Optimal solutions depend on outcomes and perspectives. For			

<p>example, engineers, funding sources, project managers, and political and others are potential influences on outcomes or solutions</p>			
<p><b>Procedural Statements</b>  <b>Standard One: Students will apply the engineering design process, troubleshooting, research and development, invention and innovation, and experimentation in problem solving and engineering design.</b>  <b>Students will:</b></p>			
<p>1P1: Learn that the engineering design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.</p>			
<p>1P2: Ask questions and make observations to help figure out how things work.</p>			
<p>1P3: Learn that all products and systems are subject to failure and that many products and systems can be fixed.</p>			
<p>1P4: Troubleshoot as a way of finding out why something does not work so that it can be fixed.</p>			
<p>1P5: Use the process of experimentation, which is common in science, to solve engineering problems.</p>			
<p>1P6: Apply the engineering design process using a variety of strategies, such as problem-solving, creative thinking, visual imagery, critical thinking, and reasoning.</p>			
<p>1P7: Apply invention as a process of turning ideas and imagination into devices and systems.</p>			
<p>1P8: Apply innovation to modify an existing product or system to improve it.</p>			
<p>1P9: Apply research and development as a specific problem-solving approach.</p>			

<p><b>2) Connecting Engineering to Science, Technology, and Mathematics</b>  <b>Declarative Statements</b>  <b>Standard Two: Students will develop an understanding of the essential concepts of and how to apply science, technology, and mathematics as they pertain to engineering design.</b>  <b>Students will develop the:</b></p>		
<p>2D1: Understanding of selected concepts from established science, technology, and mathematics standards.</p>		
<p><b>Through multiple experiences, students will:</b></p>		
<p>2D2: Understand basic concepts of science, such as, inquiry, biological processes, chemical reactions, motions and forces, and interactions of energy and matter.</p>		
<p>2D3: Understand properties of materials and how conditions affect those properties</p>		
<p>2D4: Understand complex systems and their constituent parts and how they are used in a number of ways in daily life, such as, in solar, political, civil, and technological systems.</p>		
<p>2D5: Understand technological concepts, such as, models are used to communicate and test design ideas and processes.</p>		
<p>2D6: Understand physical science, such as, chemical reactions, motions and forces, and interactions of energy and matter.</p>		
<p>2D7: Understand mathematical concepts, such as, innumeracy, algebraic equations, and probability and estimation.</p>		
<p>2D8: Understanding that engineering is connected to other fields of study, such as, the humanities and social sciences.</p>		

<p>2D9: Understanding of how knowledge acquired in one context, such as biology, is applied in another context, such as biotechnology. For example, the biotechnology industry is learning the importance of properly applying production techniques with bioprocesses and the problems that can occur in producing a product.</p>			
<p>2D10: Understanding of how things work or why things work the way they do and how design solutions rely upon the knowledge of science, technology, and mathematics and prior results.</p>			
<p>2D11: System thinking involves thinking about things as systems, which means looking for how every part relates to others.</p>			
<p>2D12: Something may not work well or at all if a part of it is missing, broken, worn out, mismatched, or misconnected.</p>			
<p><b>Procedural Statements</b>  <b>Standard Two: Students will be able to apply concepts of science, technology, and mathematics in an engineering design process.</b>  <b>Students will:</b></p>			
<p>2P1: Apply their knowledge of science, technology, engineering, and mathematics when solving practical problems.</p>			
<p>2P2: Analyze and solve formulated engineering problems.</p>			
<p>2P3: Use contemporary engineering tools, such as, computer-aided drawing (CAD), computer aided manufacturing (CAM), calculators, and spreadsheets to communicate and demonstrate their use of science, technology, and mathematics knowledge.</p>			

<p><b>3) Nature of Engineering</b>  <b>Declarative Statements</b>  <b>Standard Three: Students will develop an understanding of the characteristics and broad scope of engineering.</b>  <b>Students will understand that:</b></p>			
<p>3D1: Engineering is the knowledge of natural science and mathematics gained by study, experience, and practice that are applied with creativity and judgment to develop ways to utilize the materials and forces of nature for the benefit of human kind. An engineer is a person who is trained in and uses scientific and technological knowledge to solve practical problems.</p>			
<p>3D2: Public perception of engineers and engineering among global cultures is diverse and not consistent.</p>			
<p>3D3: Engineering and engineering technology disciplines have a common core of knowledge and areas of specializations.</p>			
<p>3D4: Engineering and human capabilities are in a cyclical relationship that influences each other over time.</p>			
<p>3D5: Engineering permeates all aspects of society.</p>			
<p>3D6: Engineering solutions have continually improved the quality of life, added business value, and significantly influenced the global economy.</p>			
<p>3D7: Engineering has intended and unintended consequences.</p>			
<p>3D8: Lifelong learning results in purposeful experiences in science, technology, engineering, and mathematics that lead to doing reflections of and building on prior knowledge in order to make</p>			

improvements to human existence.			
3D9: Humankind has the inherent need to engineer.			
<p style="text-align: center;"><b>Procedural Statements</b></p> <p><b>Standard Three: Students will be able to be creative and innovative in their thought process and actions.</b>  <b>Students will:</b></p>			
3P1: Use engineering as a vehicle for creative and critical thinking and inquiry.			
3P2: Logically segment problems and opportunities from an engineering perspective to derive effective solutions.			
3P3: Show how to integrate the knowledge from diverse sources and experiences into practice in order to consider how to solve practical problems.			
3P4: Explain what engineers do in order to solve practical problems and the reasons there is a need for diversity in engineering.			
<p style="text-align: center;"><b>4) Communication and Teamwork</b></p> <p style="text-align: center;"><b>Declarative Statements</b></p> <p><b>Standard Four: Students will develop an understanding that engineers need to communicate effectively as individuals and as members of a team.</b>  <b>Students will understand that:</b></p>			
4D1: Complex problems are better solved by teams rather than by individuals.			
4D2: Effective individual and group communication skills are learned attributes.			
4D3: Roles of team members are an important aspect in learning to work collaboratively and cooperatively			
4D4: Engineers use universal standardized symbolic languages to			

communicate, such as, mathematical equations, drafting standards, American Society of Heating, Refrigerating, and Air-condition Engineers, Inc. (ASHRAE) Handbook, American National Standards Institute (ANSI) Standards, and related professional codes.			
4D5: Engineered outcomes must be documented to accepted standards with precision in order to aid in avoiding unnecessary harm.			
4D5: Communication of ideas is effective when proper media is used.			
4D6: Multidisciplinary and cross-functional teams bring a variety of skills and perspectives that enhance the engineering process.			
<p style="text-align: center;"><b>Procedural Statements</b></p> <p><b>Standard Four: Students are able to use effective communication and teamwork skills to acquire information and convey engineered outcomes to a variety of stakeholders. Students will be able to:</b></p>			
4P1: Use appropriate communication procedures, such as, research, presentations, and documentation protocols.			
4P2: Follow patent process and recognize the need for proper documentation.			
4P3: Follow drafting standards and recognize the need for following procedures and protocols.			
4P4: Use professional standards, such as ANSI and ASHRAE to aid communication.			
4P5: Follow professional codes, such as, those for the International Fire Code (IFC).			
4P6: Follow style manuals in writing, such as, those provided by the American Psychological Association (APA) publication manual.			
4P6: Communicate effectively using multiple media.			



<p>cultures varies greatly depending on the historical impacts and the desirable and undesirable engineered developments, such as advances in medicine, public health, consumer goods, resources, energy, and changes in social mores.</p>			
<p><b>Procedural Statements</b>  <b>Standard Five: Students will be able to investigate and analyze the impact of engineering on a global society.</b>  <b>Students will:</b></p>			
<p>5P1: Investigate and analyze the impact of engineering from multiple perspectives, such as, economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.</p>			
<p>5P2: Identify constraints and external factors and explain how they impact engineering outcomes, such as, economic, societal attitudes, and optimization.</p>			
<p>5P3: Investigate and study the positive and negative results of engineering.</p>			
<p>5P4: Learn that ethical considerations are important in the development, selection, and use of engineered products and systems.</p>			
<p>5P5: Analyze the transfer of an engineered outcome from one society to another and how it may affect positively or negatively both societies, such as, the sharing of flash freezing of food and how societies changed as a result.</p>			

K-12 Engineering/Engineering Technology Standards Meeting  
October 15-18, 2006, Peabody Court Hotel, Baltimore, MD

The National Content Standards for K-12 Engineering/Engineering Technology initial development meeting convened by the Corporate Member Council (CMC) of the American Society of Engineering Education (ASEE) and the National Association of State Directors of Career Technical Education Consortium (NASDCTEC).

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