Unit 2 – Design Solutions

Preface

This unit advances your design skills in the area of geometric shapes and solids, dimensioning, 3D modeling software, and an advanced design. You will learn how to calculate area and properties of solids. You will be introduced to working in teams and what it takes to come to a consensus. The unit will end with you using the design process to create a solution to a prescribed problem.

Concepts

1. Geometric shapes describe the two or three dimensional contours that characterize an object.
2. The properties of volume and surface area are common to all designed objects and provide useful information to the engineer.
3. Working drawings should contain only the dimensions that are necessary to build and inspect an object.
4. Solid modeling programs allow the designer to create quality designs for production in far less time than traditional design methods.
5. Engineers use CAD models, assemblies, and animations to check for design problems, verify the functional qualities of a design, and communicate information to other professionals and clients.
6. A design process most used by engineers includes defining a problem, brainstorming, researching, identifying requirements, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing, refining, making, and communicating results.
7. Teamwork requires constant communication to achieve the goal at hand.
8. Fluid Power Concepts could be used to enhance design solutions.

Essential Questions

Lesson 2.1 Geometric Shapes and Solids

1. What are some examples of simple geometric shapes?
2. What two-dimensional shapes are most often associated with three-dimensional forms?
3. For what reasons might a designer need to know the volume and surface area of an object?
4. What is the difference between a geometric constraint and a numeric constraint?
5. What kind of additive and subtractive processes are used to manufacture actual physical objects?

Lesson 2.2 Dimensions and Tolerances

6. What is a working drawing?
7. What are dimensioning standards and how are they used?
8. What determines the location of the origin or datum from which all of the edges and features of an object are dimensioned?
9. What is a tolerance?
10. What effect can trailing zeroes in the dimension text have on the cost of a part?
11. Why is it necessary to use common units on a drawing for all dimensions?

Lesson 2.3 Advanced Modeling

12. What are the six degrees of freedom that an object has in space?
13. How do assembly constraints differ from geometric and numeric constraints?
14. What is the difference between an assembly and a subassembly?
15. For what reason might an engineer need to create an auxiliary view of an object?
16. For what reason might an engineer need to create a section view of an object?
17. What is a title block?
18. What information is typically on a title block?
19. What is an assembly drawing?
20. What purpose do balloons and a parts list serve in an assembly drawing?
21. What kind of information may be included in a parts list?

Lesson 2.4 Advanced Designs

22. What is a design brief?
23. Why is a design process so important to follow when creating a solution to a problem?
24. What is the purpose of design constraints?
25. What is a decision matrix and why is it used?
26. What does consensus mean, and how do teams use it to make decisions?
27. How are visual design principles and elements used to capture a consumer's attention?
28. How is the design of a consumer product different then the design of a product used to help a manufacturing process?
29. What is fluid power?
30. What is the difference between hydraulic and pneumatic power systems?
31. How does the use of fluid power aid the use of electronics or other power systems?

Lessons