3D Printing and Design Contest

Open to all students who have access to 3D design software.

PLEASE PAY CLOSE ATTENTION TO UNDERLINED ITEMS.

OBJECTIVES

1. To promote creativity.
2. To develop and demonstrate problem solving skills.
3. To require students to display skills using 3D software.
4. To exhibit principles of dimensioning on all prints.
5. To document design process from conception to conclusion.

CLOTHING / PPE REQUIREMENTS

1. For men: Official red blazer or jacket; black slacks with white button-down shirt, black socks, black shoes, black tie.
2. For women: Official red blazer or jacket; black dress skirt (knee-length) or slacks with businesslike white, collarless blouse or white blouse with small, plain collar that may not extend onto the lapels of the blazer; black sheer or skin-tone seamless hose and black dress shoes.
3. ANSI Z87.1-approved protective eyewear
4. The above clothing-based regulations refer to items that are pictured and described at: www.skillsusastore.org

SCOPE OF THE CONTEST

Skill Performance -The contest will require each student to design, draw, and submit a file for a device to be professionally printed and eventually be displayed at the contest site. The evaluation process will include the submission of a provided working drawing (correct orthographic views), an isometric drawing, the professionally printed 3D model, and a notebook.

CONTEST GUIDELINES

Each contestant will design a part and submit a STL file, with build orientation specifications, to discoverycenter.fablab@gmail.com by February 5, 2018 at 4pm. All files submitted will receive an email confirmation from the contest coordinator. The submitted files will be 3D printed and have support material removed prior to the event. At the event, each contestant will have 30 minutes to finish his/her part as needed with post-processing tools that will be provided by the event coordinator.
The model must be an original and creative work of the student. This may include creative improvements to an existing item. Models may not be glued, welded, or use commercially procured fasteners to be held together and must not be painted.

Model Size – The maximum model size is 5”x5”x5”, and must not consume greater than 5 cubic inches of printed material. Please consider the effect that part wall thickness will have in a fused deposition modeling environment.

Notebook - A notebook must be completed for each entry. The notebook must follow a reasonable design process and examples of such are included. The notebook must contain sketches with annotations, photos, and supporting evidence of development of the 3D model by the use of daily entries. List possible manufacturing processes which may be used to mass-produce the item. A daily dated journal must be included within the notebook.

Drawings - Drawings will be generated using a 3D drawing program. Orthographic drawings will be provided following general dimensioning guidelines and principles and common practice layout. An isometric drawing will also be provided either by itself or within the orthographic drawings. An exploded view will be provided to show all components. A bill of materials will be included on the appropriate drawing. All drawings will have title block which must include at a minimum, information related to drawn by, scale, tolerance, date, and material.

Resume - Is required.

Letter of Verification - A letter certifying the model was designed and constructed by the student will be submitted. The letter will be typed on school letterhead which identifies the full name of the advisor and student, the middle school or high school, with the applicable principal's signature.

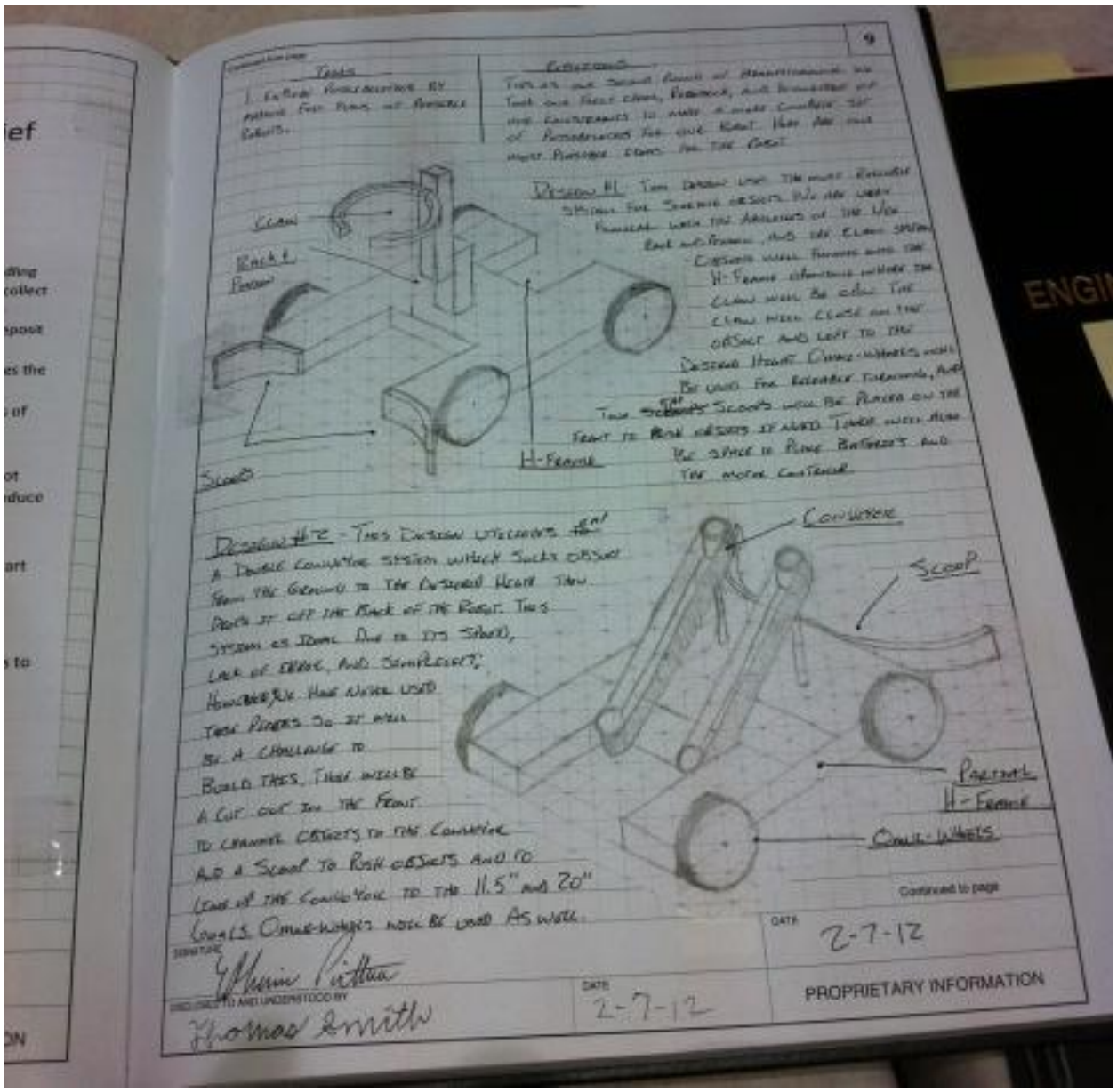
Presentation - If the student's model is an improvement of an existing item, the student will need to defend the reason(s) of his/her enhancement. If the model is a new design, the student will explain the purpose of his/her design. The student will be prepared to participate in a 3 to 5 minute presentation with a question and answer session immediately following the presentation.

CONTEST SCORECARD

Verification Letter	25 points
Model Evaluation	50 points
Drawings Evaluation	50 points
Presentation	50 points
Notebook	100 points
Design Process	25 points
Clothing / PPE	25 points
Resume	25 points
Subtotal	350 points

Over/under 3 to 5 minutes-10 points Time Penalty _____

Note Book example.



General Rules for Dimensioning

1. Dimensions should NOT be duplicated, or the same information provided in two different ways.
2. No unnecessary dimensions should be used other than those which are needed to produce or inspect the part.
3. Dimensions should be placed at finished surfaces or important center lines.
4. Dimensions should be placed so that it is not necessary for the observer to calculate, scale or assume any measurement.
5. Dimensions should be attached to the view that best displays the shape of the feature to be dimensioned.
6. Dimensioning to hidden lines should be avoided.
7. Dimensions should not be placed on the object, unless that is the only clear option.
8. Overall dimensions should be placed the greatest distance away from the object so that intermediate dimensions can nest closer to the object to avoid crossing extension lines.
9. A dimension should be attached to only one view (i.e., extension lines should not connect two views).
10. Dimension lines should never be crossed.
11. A center line may be extended and used as an extension line.
12. Leaders should slope at a 30, 45 or 60 degree angle.
13. Dimension numbers should be centered between arrowheads, except when using stacked dimensions where the numbers should be staggered.
14. In general, a circle is dimensioned by its diameter, an arc by its radius.
15. Holes should be located by their center lines.
16. Holes should be located in the view that shows the feature as a circle.
17. Extension lines start approximately 1/16” from the object and extend 1/8” past the last dimension.
18. The first dimension is approximately 3/8” from the object and each associated dimension spaced uniformly approximately 1/4” apart.
19. Dimensions should reflect the actual size of the object, not the scaled size

Examples of Design Process

1. Identifying problems and opportunities
2. Framing a design brief
3. Investigation and research
4. Generating alternative solutions
5. Choosing a solution
6. Developmental work
7. Modeling and prototyping
8. Testing and evaluating
9. Redesigning and improving

**Design and Problem Solving in Technology*

1. Identify the need
2. Define the criteria
3. Explore/research/investigate
4. Generate alternate solutions
5. Choose a solution
6. Develop the solution
7. Model/prototype
8. Test and evaluate
9. Redesign and improve

**Engineering Drawing and Design*

RUBRICS

Model

Topic	8	6	4	2
Size	Does it fall within the 5"x5"x5" requirement.			No, it does not.
Model is not glued, welded, or painted.	Yes			No
Scale	Does the scale of the model match the drawing?			No, it does not.
Components	Does the model design incorporate easy of manufacturability?	One part will be difficult to produce.	More than one piece will be difficult to produce.	No, it does not.
Fit	Individual parts fit or nest together to produce an assembly which matches the isometric dimensions and tolerances.	Assembly is beyond +/- 0.0625	Assembly is beyond +/- 0.09375	Assembly is beyond +/- 0.125
Effectiveness	The model performs the desired outcome.	The model performs, but has one glitch.	The model performs, but has several glitches.	The model does not perform.

NOTEBOOK

Topic	4 pts	3 pts	2 pts	1 pts
Organization	Notebook contains a chronological section, as well as sections for sketches, reference sources, people, business contacts, etc.	Parts of the notebook show organization; however, some parts are mixed into other sections.	Notebook is sloppy or haphazardly organized.	No evidence of organization exists.
Daily Entries (Journal)	Details of information gathered and work accomplished for each day are entered.	Notebook is missing a few daily entries.	Notebook is missing many entries.	No entries have been added since last check.
Content	Notebook entries are sufficiently descriptive to completely recreate the daily accomplishment.	Most information is detailed; however, important details are missing to complete the task.	Notebook entries are insufficiently descriptive to completely recreate the daily accomplishment.	Content is missing.
Drawings and Sketches	Notebook contains sketches and drawings that are related to the topic and express what will be created.	Sketches are drawn explaining the topic but are poorly done.	Quantity of sketches and drawings is insufficient to explain the topic.	Sketches are not used where necessary.
Neatness	All entries are done with same color of ink or lead except for color coding views. No erasures, tears, creases, staples, or stains present.	Almost perfect. Above average appearance.	Average appearance. Some issues with color and condition of pages.	Very messy, no regard for appearance.

DESIGN PROCESS

Topic	4 pts	3 pts	2 pts	1 pts
Research	Applied varied research skills to find and evaluate resources. Used information and resources to accomplish real world outcomes.	Applied research methods to find and evaluate resources.	Located and documented the source of information.	Provided little or no information or resources.
Communication	Used various means with excellence to engage readers and audiences to learn of the outcome.	Was not fully mastered in all of methods of communication.	Was lacking some methods of communication.	Provide only the minimum to engage the reader and audience in learning.
Critical Thinking	Used multiple resources to plan, design, and execute real-world problems.	Limited use of technology and resources to make decisions and solve problems.	Very limited use of technology and resources to make decisions and solve problems.	Could on elaborate on the reasoning behind their decisions or problem solving methods.
Innovation	Applied critical thinking, research methods (manufacturing processes), and communication tools to create original work.	Applied existing knowledge to create ideas and products.	Engaged in some activities create a limited product.	Copied existing ideas without improvement.

DRAWING

(refer to guidelines)

Topic	4 pts	3 pts	2 pts	1 pts
Views				
Dimensioning				
Geometric Dimensioning &Tolerances				
Title Block Data				
Bill of Materials				
Neatness/Quality				

PRESENTATION

Topic	4 pts	3 pts	2 pts	1 pts
Content	Thoroughly and clearly states the main points and precise details that are accurately focused on the design solution.	Adequately states the main points and details that area accurately focused on the design solution.	States most of the main points and details that focus on the design solution. May include some unnecessary information.	States few main points and details that focus on the design project, or information does not relate to topic.
Organization	Clearly organized into a logical sequence. Excellent introduction and conclusion.	Adequate evidence of a logical sequence of information. Satisfactory introduction and conclusion.	Fair evidence of a logical sequence of information. Weak introduction and conclusion.	Minimal or no outline followed. Not logical organization: some digressions. Unclear confusing. No introduction or conclusion.
Delivery	Effectively and creatively delivers the information while staying on the topic and considering the audience. Uses voice variation; interesting and vivid to hear.	Adequately delivers the information while staying on the topic and considers the audience. Speaks clearly and confidently.	Delivers the information but does not stay on the topic. Little consideration of audience. Uses confusing language.	Little or no attempt is made to stay on topic. Does not consider audience. Difficult to follow and understand.
Preparation	Presentation shows detailed preparation and practice in delivery including the use of voice, posture, eye contact, gestures, pacing, and use of pictures, graphs, computer models, etc. Interesting and vivid.	Presentation shows satisfactory preparation as well as practice in delivery including use of voice, posture, eye contact, gestures, pacing. Some use of pictures, graphs, computer models, etc.	Presentation shows some preparation as well as some practice in delivery including marginal use of voice, posture, eye contact, gestures, pacing, and marginal use of pictures, graphs, computer models, etc.	Presentation is lacking in preparation and in practice of the delivery including use of voice, posture, eye contact, gestures, pacing, and little or no use of pictures, graphs, computer models, etc. Difficult to hear. Speaker appears tense and fidgets often.