

# LATHROP ENGINEERING

Name: \_\_\_\_\_

## UNIT 8: PRODUCT ENHANCEMENT

Introduction to Engineering & Design

Unit Due Date: **February 21, 2020**

Welcome to the eighth unit of *Introduction to Engineering & Design*! This unit is all about digging into the more technical aspects of dimensioning sketches, creating multiple views of complicated objects, and defining tolerances for your designs. We'll also get to work more in Autodesk and assemblies as we create assemblies that can move. In the end, the expectation is that you learn the following:

- How to **fully dimension** a drawing both by hand and in Autodesk
- How to create **sectional views** in Autodesk and when to use them
- How to add **tolerances** to your diagram and when they are needed
- How to create complex assemblies using the **translational constraint**
- How to use a decision matrix to identify product enhancements

As we move through this unit, you are responsible for making adequate progress through the assignments, and for being done by the Unit Due Date (**February 21, 2020**). You are also responsible for completing each part before moving on to the next. Our unit is broken up into three main parts:

Part 1: <b>Dimensions, Views, &amp; Tolerances</b> (30 pts) Approx. 3 days	
The first part of our unit includes more advanced methods of dimensioning complex objects, creating alternate views in Autodesk, and creating tolerances within Autodesk diagrams. You'll start with some notes on those three big topics before completing the <i>Advanced Dimensioning</i> work in Autodesk by building some new parts and using them to make more complicated diagrams in Autodesk.	 Notes on Dimensioning
	 Notes on Views
	 Notes on Tolerances
	 Advanced Dimensioning
	 Check-off From Mr. Benshoof
Part 2: <b>Assemblies</b> (20 pts) Approx. 2 days	
The second part of the unit covers advanced techniques in creating Autodesk Assemblies. In particular, you get to look at how to use translational and axial constraints to make assemblies that can move in the computer. We'll complete a short tutorial to construct the <i>Cam Assembly Tutorial</i> before we dig into the details of real engineering documentation conventions.	 Advanced Assemblies
	 Cam Assembly Tutorial
	 Engineering Documentation
	 Take Unit 8 Quiz
	 Check-off from Mr. Benshoof
Part 3: <b>Automoblox Enhancement</b> (30 pts) Approx. 3 days	
Finally, we'll return to the Automoblox cars one more time. You'll complete an entire reverse engineering process on your Automoblox car by doing a visual, structural, and functional analysis. Then you'll take the time to brainstorm, sketch, design, and model an improvement to the Automoblox vehicle. Once you've modeled the improvement in Autodesk, we'll 3D print that improvement and see if it works with your car as intended!	 Reverse Engineer Automoblox
	 Design/Dimension Improvement
	 3D Print Improvement
	 Check-off from Mr. Benshoof



(30 pts) Approx. 3 days

The first part of this unit gives you a chance to learn more about the details of properly dimensioning a diagram. You'll look at different types of dimensioning standards and practice fully dimensioning. You'll keep learning about new types of views called sectional views, how to add tolerances to a dimensioned part, and also how holes of different types are diagramed. With all these tools together, fully dimensioning your diagrams becomes easier. You'll then take those skills as you complete an assignment in Autodesk modeling and diagraming different parts.

1. **Notes: Dimensioning & Drawings:** Start by watching the videos *Dimensioning Standards* and *Alternate Views for Drawings*. Take a full page of notes on those two presentations in your engineering notebook. Make sure that your notes include specifics on what the expectations are when dimensioning a diagram, as well as when and how to use sectional views in a diagram.
2. **Notes: Tolerances & Holes:** Next, watch the *Tolerances* and *Dimensioning Holes* presentations. Take another full page of notes on these two presentations. Make sure that your notes include details on what kinds of tolerances can be included in a diagram as well as what characteristics of a hole can be included in properly dimensioned diagrams.
3. **Advanced Dimensioning Assignment:** Finally, get the *Advanced Dimensioning Assignment* from Mr. Benshoof and use Autodesk to model the necessary pieces. For each, you will also create an Autodesk diagram that is fully dimensioned and uses the new tools described in the assignment. Make sure that your diagrams are printed and complete!

Part 1: Tasks	10-7 points	6-4 points	3-0 points
 Notes: Dimensioning & Drawings	+ You took a full page of notes on the ideas in the <i>Dimensioning Standards</i> and <i>Alternate Views for Drawings</i> presentations + Your notes include details about the proper ways to fully dimension drawings + Your notes include details on sectional views	- Your notes are missing information on dimensioning standards - Your notes are missing details on sectional views	- Your notes are missing many key components - Your notes are completely missing
 Notes: Tolerances & Holes	+ You took a full page of notes on the ideas in the <i>Tolerances</i> and <i>Holes</i> presentations + Your notes include details on how tolerances communicate parameters + Your notes include details on how holes of different kinds are notated	- Your notes are missing details on including tolerances in diagrams - Your notes are missing details on how holes can be properly dimensioned	- Your notes are missing many key components - Your notes are completely missing
 Advanced Dimensioning Assignment	+ You completed the <i>Advanced Dimensioning Assignment</i> + Your Autodesk Diagrams are printed and turned in	- Your <i>Advanced Dimensioning Assignment</i> is incomplete	- Your assignment is missing



(20 pts) Approx. 2 days

The second part of our unit is much quicker than the last. In addition to adding to our ideas and conventions for diagram and documenting our work, this part of the unit also looks at how to make more advanced assemblies in Autodesk. The biggest part of this unit is to follow a tutorial video that creates a ‘cam assembly’ as you construct your own. A “Cam” is a disk – sometimes round, sometimes other shapes – that when turned can convert rotational motion into linear motion. We looked at cams last semester when we did our mathematical modeling. Here you’ll create a cam assembly in Autodesk so that in a future unit you can design and build your own cam project!

1. **Advanced Assemblies:** Start by watching the *Advanced Assembly Constraints* presentation. Take a full page of notes on the ideas presented here. Make sure that your notes include specific details on the new Autodesk tools and constraints that the presentation describes. These tools will be essential as we move forward with our cam assembly.
2. **Cam Assembly Tutorial (Part 1):** Next, watch the *Cam Assembly Tutorial* presentation and add to your notes on assemblies. This tutorial shows what constraints to use in order to build a functioning ‘cam assembly’. The machine you’ll *actually* build in Autodesk will be slightly different, but all the same tools and procedures can be used to make it work!
3. **Cam Assembly Tutorial (Part 2):** Now you get to actually build this in Autodesk! Download the *AutomataSimulation* folder from our website. This folder contains ALL of the Autodesk parts you’ll need to create the cam assembly. Follow these steps (and the steps from the tutorial video) to create your complete assembly:
  - a. **Download** the Automata Simulation folder and unzip its contents onto the desktop
  - b. **Make** a new Assembly in Autodesk and **place** one copy of every cam assembly item (box, hexCam, etc) into the assembly
  - c. **Follow** the guidelines from the tutorial video to assemble your working cam!
4. **Engineering Documentation:** Finally, review the *Engineering Documentation* presentation from the website. Take a full page of notes on the ideas presented here. Think about your own notes, notebook, and documentation. How can you improve your notebook?

Part 2: Tasks	2 points	1 points	1-0 points
 Advanced Assemblies	+ You took a full page of notes on the <i>Advanced Assembly Constraints</i> and <i>Cam Assembly Tutorial</i> + Your notes include specific explanations of the tools described	- Your notes are missing a few key components	- Your notes are missing many key components - Your notes are completely missing
 Cam Assembly Tutorial	+ You followed the ideas from the <i>Cam Assembly Tutorial</i> to build your cam assembly + You used the parts linked in the <i>AutomataSimulation</i> folder to build your cam assembly	- Your cam assembly does not move properly - Your cam assembly is not fully assembled	- Your cam assembly is missing completely - Your cam assembly is not saved to your jump drive
 Engineering Documentation	+ You took a full page of notes on the <i>Engineering Documentation</i> presentation. + Your notes include details about what good documentation includes	- Your notes are missing a few key components	- Your notes are missing many key components - Your notes are completely missing
 Take Unit 8 Quiz	+ You took the Unit 7 Quiz on the website by the Quiz Due Date + Grade is based on number correct	N/A	(0 pts) You did not take the Unit 7 Quiz



(30 pts) Approx. 3 days

The final part of our unit has you do some designing and engineering around improving an Automoblox car. We'll return to the same Automoblox car that you modeled in Autodesk last semester. (That way, you should still have some Autodesk files to get you going). You'll start with the reverse engineering process to learn about and understand your Automoblox car better. Then you'll brainstorm and design an improvement to your car before you 3D model it and we print it!

1. **Reverse Engineering:** Get your Automoblox car (the same one you worked with last semester) and complete a reverse engineering analysis of it. This must include: a **visual analysis, structural analysis, and functional analysis** of the car and its parts. Make sure that you record your reverse engineering analysis in your engineering notebook and complete a dismantling chart as you take apart your Automoblox car.
2. **Design Improvement:** Now you get to design, develop, and model your Automoblox car improvement! Follow these steps – recording in your notebook along the way – to design your improvement:
  - Brainstorm at least 10 design improvements to your Automoblox car
  - Pick an improvement you like and that you want to work on. Draw it carefully in your engineering notebook. Include proper dimensions.
  - Model your improvement carefully in Autodesk. It needs to be exactly the right sizes so that when we print it, it fits!
  - If possible, use your previous Autodesk model to assemble your improved Automoblox car. If everything was built correctly, then it should all fit together properly.
3. **3D Print:** With your Automoblox improvement modeled in Autodesk, the last step is to 3D print it! Get your improvement 3D printed, and then confirm that it fits your car and works as you intended!

Part 3: Tasks	5 points	4-3 points	2-1-0 points
 Reverse Engineer Automoblox	+ You did a visual analysis of your Automoblox car + You did a structural analysis of your Automoblox car + You did a functional analysis of your Automoblox car + You dismantled your Automoblox car, filling out a dismantling chart	- You missed some component of the reverse engineering process.	- You missed more than one component of the reverse engineering process.
 Design/Dimension Improvement	+You brainstormed and sketched ideas for improvements in your notebook + You clarified your Automoblox improvement with detailed designs in your notebook + You modeled your Automoblox improvement in Autodesk	- You did not record your product improvement process in your engineering notebook - You did not complete your Autodesk model	- Your improvement is poorly defined - Your Autodesk model is lacking or completely missing
 3D Print Improvement	+ We 3D Printed your Automoblox improvement + Your Automoblox improvement fits your car & works as intended	- Your 3D printed part does not work as intended	- Your 3D printed part is missing

