

UNIT 1: ENGINEERING DESIGN PROCESS

Introduction to Engineering & Robotics

Unit Due Date: **September 6, 2019**

Welcome to the very first unit of Engineering and Robotics: *the Engineering Design Process*. Real-life engineers use the Engineering Design Process to tackle problems of all kinds. This process starts by (1) defining the problem and (2) brainstorming solutions. Then it moves on to (3) choosing a solution and (4) building a prototype. Perhaps most important are the tasks of (5) evaluating and (6) communicating our work. In this unit, your team will go through that process to tackle a problem as part of UAF's Arctic Innovation Design Competition. In the end, the expectation is that you learn the following:

- How the Engineering Design Process is used by engineers to solve problems
- What a Design Brief is and how it is used to define a problem
- How to Brainstorm solutions
- How to develop a project proposal
- How to communicate your project ideas to others through images, text, and presentations

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 (**September 6, 2019**). 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: Design Brief & Brainstorm (30 pts) Approx. 2 days	
This unit is completed with your E-Group team. Throughout the entire unit you need to coordinate with your team, though everyone needs to write their own responses. You'll start by choosing a real-life problem and developing a design brief in your engineering notebook. Then you'll work with your team to research & brainstorm at least 20 ideas for solutions.	 Take Notes on EDP Introduction
	 Develop Your Design Brief
	 Check-off From Mr. Benshoof
	 Research & Brainstorm 20 Ideas
	 Brainstorming Assignment
Part 2: Pick & Describe Solution (30 pts) Approx. 3 days	
Once you've completely defined your idea and brainstormed lots of possibilities, your team needs to decide what solution you want to go with. As a group, agree upon what your solution is. Next, everyone needs to draw a very careful sketch of your solution including labels and dimensions. Decide who will write each Mini-Essay and get those written and edited!	 Describe Your Chosen Solution
	 Sketch Your Solution
	 AIC Mini-Essays
	 Unit 1 Quiz
	 Check-off from Mr. Benshoof
Part 3: Design & Communicate (40 pts) Approx. 3 days	
Finally, submit your AIC designs and Mini-Essays to UAF's online Arctic Innovation Design Competition submission website. (Deadline for submission is: September 6). Then, work with your team to create an evaluation matrix, and then use that matrix to get feedback from at least 2 other students. The last step is to get into Autodesk so that each team member can create their own 3D model of your solution.	 Team Upload to AIC (Sept 21)
	 Evaluation Matrix
	 Receive Peer Feedback x2
	 Autodesk Model of Solution
	 Check-off from Mr. Benshoof



(30 pts) Approx. 2 days

This project starts with the creation of your E-Group teams. Those teams will change throughout the year, but the team you’re on for this project will be your team for the next three weeks. As a team, you need to start by identifying a problem in the community, in our school, or in your daily life. Once your team has decided what problem they want to address, then it’s time to start developing your solution. Work with your team to follow the steps carefully below:

- Process** - Start by watching the video on the Engineering Design Process. Pay close attention to the six steps in the process and take good notes on what each step involves.
- Problem** - Talk with your team and officially decide what problem you want to tackle. Remember, the problem can be something impacting Fairbanks, Lathrop, or just your team as individuals. Some different problems that could be addressed by your team include:

Unhealthy air in the winter

Cold noses walking outside

Not waking up on time for school

Lathrop Students getting tardy passes quickly

- Design Brief** - Now that your problem has been decided, work with your team to write out your design brief. Watch the “Design Brief” video to get started. Each person needs to write the design brief in their own engineering notebook. “One per team” doesn’t work. Make sure that your design brief includes a definition and explanation of the problem, a deadline, criteria for success, and building constraints.
- Approval** - Have Mr. Benshoof *approve your design brief* before moving on!
- Research & Brainstorm** - Watch the short video “Research & Brainstorm”. Take some time as a team to do some research on your problem. Then brainstorm at least 20 ideas for possible solutions. Every person must record all 20 ideas in their engineering notebook!
- Brainstorming Assignment** – You completed the Brainstorming Assignment linked from the website *before* you took the Unit 1 Quiz. You can complete the Brainstorming Assignment in your engineering notebook or on the handout sheet. Have Mr. Benshoof check off your completed brainstorming sheet before you take the quiz!

Part 1: Tasks	5 points	4-3 points	2-1-0 points
 Engineering Design Process Notes	+ Complete notes from the Engineering Design Process Video. + Notes cover all 6 steps in the EDP	3 points only if: - Notes are missing 1 of the design steps	- Notes are missing 2 of or more steps in the design process
 Design Brief	+ Design brief is written in engineering notebook + Design Brief has all 5 components	- Design brief is missing 1 or 2 pieces	- Design brief not in notebook - Design brief missing more than 2 pieces
 Design Brief Continued	+ Design brief includes criteria + Design brief includes constraints	- Design brief is missing either criteria or constraints	- Design brief is missing BOTH criteria AND constraints
 Research & Brainstorm	+ At least 20 ideas have been brainstormed and recorded in your engineering notebook + All ideas are addressing your chosen problem	- More than 10 ideas have been recorded - Many ideas are not connected to the problem	- 10 or fewer ideas have been recorded - Ideas are not connected to the problem
	10 points	9-5 points	4-0 points
 Brainstorming Assignment	+ You completed the Brainstorming Assignment sheet + You completed the Brainstorming Assignment before taking the Unit 1 Quiz	- You did most of the Brainstorming Assignment	- You did not complete the Brainstorming Assignment



(30 pts) Approx. 3 days

The second part of our project requires that your team think and work together to combine the best of your ideas into one workable solution. Your solution should fit the criteria and constraints that you outlined in your design brief. Next, you'll write a description of your product and make a nice concept sketch. Finally, your group will need to assign 5 short essay topics to your team members to write. Some team members may need to write more than one. Have your team members edit your responses for grammar and clarity

1. **Describe Your Solution** – agree with your group about what your solution is. Then write a 5-sentence explanation of the solution including what it is, how it solves the problem, and what the potential positives and negatives are.
2. **Sketch Your Solution** – take time to make a nice concept sketch (Multiview, isometric, or perspective) of your solution. Be sure to include labels and approximate dimensions in your sketch.
3. **AIC Mini-Essays** – Distribute the 5 essay topics below to your team. Some people may have to write more than one. Write a clear essay between 1300 and 1500 *characters* fully answering the question.

Mini-Essay #1	Mini-Essay #2	Mini-Essay #3	Mini-Essay #4	Mini-Essay #5
Give a general description of your idea. (Pictures can be uploaded as well)	Who does your idea help and how does it help them? Explain how your idea solves a problem or addresses an unmet need.	How is your idea original? What makes your idea new and exciting? What has research shown about similar ideas?	How would you make your idea into a reality? What are the next steps for your idea to be taken to market for people to buy/use?	How will this idea be profitable? How is your idea financially sound? What economic value will your idea create?

*****Plagiarized essays will earn you a zero (0) on the entire assignment*****

Part 2: Tasks	5 points	4-3 points	2-1-0 points
 Describe Your Solution	+ Write at least 5 sentences in your engineering notebook describing your team's solution. + Also describe the possible positives/negatives	- Description is less than 5 full sentences - Missing positives or negatives of the solution idea	- Fewer than 3 sentences in your description - Missing positives and negatives
 Sketch Your Solution	+ Sketch is carefully done + Sketch includes labels + Sketch includes proper dimensions	- Sketch is missing 1 or 2 of the components needed	- Sketch is missing 3 or more items from what is needed
 AIC Mini-Essays	+ Your assigned Mini-Essay(s) are within 90% of the required length + Your assigned Mini-Essay(s) completely answers the question	- Your Mini-Essay is too short/long - Your Mini-Essay(s) do not answer all prompts	- Your Mini-Essay is significantly too short - Your Mini-Essay(s) do not answer the question
 AIC Mini-Essays Continued	+ Your assigned Mini-Essay(s) are reviewed and edited by a team member + Your assigned Mini-Essay(s) are well-written and complete	- Your Mini-Essay is not edited by a team member - Your Mini-Essay is not well written	- Your Mini-Essay is very poorly written <i>*Plagiarized Essays will earn you a 0 on the entire assignment</i>
	10 points	N/A	0 points
 Unit 1 Quiz	+ Up to 10 points – your grade is based on how many questions you get correct		- You did not take the Unit 1 quiz before August



(40 pts) Approx. 3 days

The Engineering Design Process concludes by evaluating your solution’s success, and communicating your ideas with others. The final part of our unit gives you time to upload your submission to the Arctic Innovation Design Competition. Next you’ll look at methods of evaluating designs, and get some feedback on your idea from other students. Finally, you’ll make a prototype of your design in Autodesk Inventor.

1. **By September 6** you and your team need to upload your Mini-Essays and best drawings to the UAF Arctic Innovation Design Competition. (<http://arcticinno.com>) This needs to be done by **September 6**, which is before the University’s deadline. If you do not get fully submitted, then you will not receive points for the AIC Upload.
2. **Evaluation Matrix** – Work with your team to create an evaluation matrix. Watch the video “Using An Evaluation Matrix” and take some notes on what must be included. Create a matrix with your team that includes at least 3 criteria. Write your evaluation matrix into your notebook.
3. **Peer Feedback** – Find at least 2 other students in the class that are not in your team. Explain your idea to them and show them your pictures. Answer any questions they might have and ask them to rate your solution using your evaluation matrix. Record any additional feedback (positive or negative) that you receive in your notebook.
4. **Autodesk Model** – Use Autodesk to create a 3D model of your solution. Make sure that your model has reasonable proportions, and that it looks like the solution your team developed. Save your 3D Part as an .IPT file on your jump drive.
5. **Blog It!** – Communicate your work with our class by writing a complete Blog Post with your team. Use the Google Form from our website to submit your Blog post.

Evaluation Matrix for <i>New Mountain Dew</i>	Rating (1-5) from Person A	Rating (1-5) from Person B
Is it an exciting color?	4	3
Does it taste good?	5	3
Is the label attractive?	3	2

Part 3: Tasks	10 points		0 points
☆ AIC Upload (10 pts)	All team submissions uploaded by the due date (Sept 6)	N/A	- Team submissions not uploaded on time
🗨️ Blog it!	+Share your work by writing a blog post for the LHS Engineering Blog	- Your blog post is incomplete	- Your team’s blog post is missing completely
	5 points	4-3 points	0 points
📄 Evaluation Matrix	+ Your team developed an evaluation matrix with 3+ criteria + Your evaluation matrix is written in your engineering notebook	- Your evaluation matrix has only 2 criteria	- Your evaluation matrix has 0 or 1 criteria
📄 Peer Feedback	+ You received feedback from at least 2 other teams + The feedback you received used your evaluation matrix + Your feedback is recorded in your engineering notebook	- You only received feedback from 1 other team - Feedback did not use evaluation matrix	- No feedback received - Feedback not connected to product - Feedback not recorded in notebook
⊕ Autodesk Model	+ Your model is built in Autodesk + Your model is recognizable	- The model is not totally recognizable	- Your model is incomplete or not done
⊕ Autodesk Model Continued	+ Your model has reasonable proportions + Your model demonstrates the solution well	- Your model does not have reasonable shape/size	- Your model does not represent the solution

