(100 pts) Approx. 6 days

This unit is all about using the engineering design process to solve a very specific problem, while working to stay within very specific constraints. The challene in this unit will not only be collecting enough data to make informed choices, but making sure that your solution fits within budget constraints and time constraints, and that you meet both pH and turbidity criteria. Developing a solution with such tight parameters is a challenge, and will require a lot of materials testing, communication, and planning.

PROBLEM SCENARIO: People around the world need clean drinking water. In some parts of the world it is very difficult for people to find clean water for drinking and cooking, and so they are forced to use unclean water. This is a problem because when people regularly consume unclean water they can get sick, and when large groups of people are all getting sick from unclean water it creates serious humanitarian problems. A solution is needed for filtering unclean water so that it is safe to drink. For the purpose of this study, we will measure pH (ideally 7) and turbidity (ideally 0 NTUs).

You will be given 1 gallon of unclean water to use for ALL of your materials testing, prototyping, and final demonstration – so plan carefully! You will need to use the available materials to test and develop a filtration system. In the end, your final filtration system needs to cost less than 100 engineering dollars, be able to filter and produce at least 100 ml of clean water in 10 minutes, and get the turbidity as close to 0 NTUs as possible as well as get the pH as close to 7 as possible.

- 1. To start, put together a design brief for the problem. Make sure that your design brief is complete, that it includes all the parts necessary for a complete design brief, and that you emphasize the criteria and constraints for the problem.
- 2. Next, look at the list of available materials and their associated cost in "engineering dollars". Brainstorm a variety of possible filtration systems and setups that you might be able to make. *Record your brainstorming with pictures!*

Filter Paper (\$30)	Charcoal Briquette (\$30)	Sand (\$15)	Potting Soil (\$10)
Paper Towel (\$10)	Cotton Balls (\$2 ea)	Sponge (\$15)	Felt (\$20)
Plastic Bottle/Tubing/Equipment (\$30 for the setup)		Special Bonus Materials TBA (\$25)	

- 3. Next, conduct some materials research to understand your materials better! Figure out how wuickly water can travel through different materials, how the depth of the material impacts the results, and how each material impacts the pH and turbidity of the water. Be careful not to use up all of your test water! As always, record your results and share them with your fellow Senior Design students!
- 4. Make a written plan (including a picture) for a first prototype of your filter.
- 5. Build your first prototype and see how well it works. Get feedback and record your success/failure with this first prototype.
- 6. Make a written plan (including a picture) for a second prototype of your filter.
- 7. Build your second prototype and see how well it works. Get feedback and record your results!
- 8. Make a decision matrix to evaluate the different materials and your prototypes. Use the results of the decision matrix to inform your final design.
- 9. Make a written plan and picture for your final design. Make sure that your final design costs no more than 100 "engineering dollars"
- 10. Test your final design to see if it:
 - a. Creates 100 ml of clean water in no more than 10 minutes
 - b. Gets the pH as close to 7 as possible
 - c. Gets the turbidity as close to 0 as possible
- 11. Draw a picture of your final solution and write a 1-page reflection on the entire process, what worked, and what didn't.

Part	1: Exploration Tasks	10-8 points	7-5 points	4-0 points
Design Brief		+ You created a complete design	- Your design brief is	- Your design brief is
		brief that details the entire water	missing some elements	missing many
		purification task		elements
		+ You took detailed notes	- Your notes do not	- No notes about
Brainstorming Notes		brainstorming different solutions	include pictures	brainstorming
		+ Your notes include pictures of	- Your notes are	
		possible systems	superficial	
		8-7 noints	6-4 noints	3-0 points
		+ You conducted materials testing	- Your materials testing	- No notes
	Materials Testing	on all the materials you thought	was very brief	
		were worth looking at	- Your results were not	
	- 0	+ Your materials testing was used	clearly used later	
		to inform future decisions		
z		+ You took good notes on your	- Your notes are overly	- Your notes are totally
0	Materials Notes	materials testing	brief	missing
		+ Your notes are well organized	- Your did not share your	
LU		and shared with others	notes with other seniors	
A		+ Your first prototype is	- Your prototype is	- Your prototype is
Ш	🕀 Build Your First	assembled completely	noticeably incomplete	missing
જ	Prototype	+ Your prototype follows your	- You did not follow your	- You did not follow
Н		plan	plan	your plan at all
RO		+ You have written plans for each	- Your records from your	- Your plan is missing
E	🗖 Build Plans	of your prototypes	prototyping and work are	- Your plan has no
Ш Ш		+ You recorded results and	incomplete	picture
		feedback from each of your		
		prototypes		
		+ Your second prototype is	- Your prototype is	- Your prototype is
		assembled completely	Noticeably incomplete	Missing
	Prototype	+ Your prototype follows your	- You did not follow your	- You did not follow
			11-10 points	
		+ You made a complete	Vour decision/evaluation	Your
		decision/evaluation matrix to	matrix is missing some	decision/evaluation
		assess your different material	narts	matrix is missing many
	ecision Matrix	ontions	- Your decision/evaluation	narts or is very
		+ Your decision/evaluation matrix	matrix does not address	incomplete
		emphasize the criteria and	all of your filtration	moomprete
		constraints	system options	
Final Filtration System		+ Your final product is well built	- Your final product is not	- Your final product is
		+ Your final product meets the	fully built	incomplete/missing
		constraints	- Your final product does	- You missed most/all
		+ Your final product meets the	not quite meet the	of your criteria &
		criteria as best as possible	criteria or constraints	constraints
岔 Achievement		+ Make a final filtration system that successfully meets all budget and time constraints		
		as well as pH and turbidity criteria by the unit deadline!		