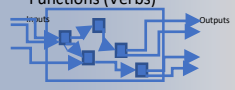
Chemical and Biological Engineering vs EGEN 310

	Discover	Define	Ideate	Prototype	Test	Communicate

EGEN 310	• ***Background Research***
	• ***Observation***
	• ***Interaction with Stakeholders***
		Discoveries distilled into:
		• Functions (Verbs)
		 
		
		• Objectives (Adverbs/Adjectives)
		 
		• Constraints = standards, non-functional design boundaries
			Generate ideas for design concepts:
			• **Functions to Morph Charts**
			 
			
			• **Objectives to Pugh Charts**
				Build a prototype to begin to fill in gaps in design knowledge
				• Prototype …
				  • To test most uncertain parts
				  • If fundamental physical modeling is not possible
				  • If statistical information is required
				  • To learn about fit and tolerance of components
				• Long List of System Interfaces
				  • FMEA
				  • System Integration
					Set up experiments and test to learn more about uncertain design aspects
					• Clearly identify variables in question
					• Define what constitutes an "effective" result
					• Summarize next steps
						Utilize MANY forms of communication to inform your team, client and stakeholders about your design process
						• *Face to Face Meetings*: Team meetings (with/without instructor), with other instructors, with Makerspace and Innovation Alley staff
						• *Written Communication*: Texts, emails, memos, A3, Readme Files, Smartsheet
						• *Visual Communication*: Fabrication drawings, terrain maps, sketches and schematics, photos, videos, charts to document design process, spreadsheets for numerical models

Chemical and Biological Engineering	• ***Process Design (typical)***
	• Determine *process goals*
	  • Understand client needs
	  • Perform a market analysis if necessary
	  • Do necessary background research
	• Determine production capacity
		• Determine *total production rate*
		  • Economic Constraints
		  • Physical Constraints
		  • *Continuous* or *Batch* Process
		• Number of Products
		• Material Conversions that need to occur
		 
		
			• Evaluate alternatives
			• For **continuous processes**, start with *block flow diagrams*
			  • General ideas for steps in the process
			  • Work towards identification and design of:
			  • Reactor system
			  • Recycled structures
			  • Separation systems
			  • Heat exchange process energy recovery
			• For **batch processing**
			  • Scheduling Operations
			  • Minimize cycle time
			  • Operations Gantt Charts
			• Equipment
				• Actual or simulated for key parts of the
				• Begin creating *process flow diagrams*
				  • Strive for clarity
				  • Define topology
				  • Define stream data required
				  • Calculate material balances for each element in each stream
				  • Specify temperature, pressure, gas/liquid composition
				• Analyze safety and broader impacts
					• Finalize PFD
					• Size equipment (size, volume, capacity, power, utilities)
					• Determine whether process is economically viable
					  • Estimate costs of equipment, operations, raw materials, energy, taxes
					  • Estimate potential profits
					• Identify all safety issues with the process
						Utilize MANY forms of communication to inform your team, client and stakeholders about your design process
						• *Face to Face Meetings*: Team meetings (with/without instructor), with other instructors
						• *Written Communication*: Texts, emails, memos, A3, Reports
						• *Visual Communication*: PFDs, spreadsheets for numerical models, Design Fair Posters
						• *Oral Communication*: Final Presentation