Engineering Design Process: Generic Inputs, Tasks & Outputs

Phase 1: Problem Definition

Inputs	*Tasks*	*Outputs*
Entry Materials (possibly including any of): ● initial problem statement ● known criteria and constraints ● stakeholders ● situational context	● **Establish qualitative and quantitative criteria** (Know/Need to Know, Criteria Tree) ● **Identify constraints** ● **Prioritize criteria** (Pairwise Comparison) ● **Clarify problem in light of context and stakeholders** (Know/Need to Know Chart) ● **Establish metrics** (Use-Value Analysis) ● **Understand Relevant Science and Math**	● Clarified problem statement: We as ____ seek to ____ in order to ____ for ____ . (Identify: role, problem, major criteria, stakeholders/ context) ● Criteria for success (qualitative and quantitative) ● Constraints ● Metrics ● Stakeholders (Note: students should not consider these products finalized and should revisit them throughout the project)

Phase 2: Design Exploration

Inputs	*Tasks*	*Outputs*
● Clarified problem statement ● Criteria, constraints, metrics, and stakeholders	● **Determine necessary system functions** (Black Box Modeling, Reverse Engineering, Action-Function Chart) ● **Develop performance targets** (Competitor Benchmarking) ● **Generate design alternatives** (Brainstorm, Mind-Map, Concept Sketching, Gallery Walk, Research, Patent Search, Function-Means Tree, Morphological Chart) ● **Compare design alternatives to criteria and constraints** (modeling/ testing) ● **Proof of Concept** (mockups, component testing) ● **Analyze and consider tradeoffs** ● **Evaluate design alternatives and select design** (Pugh Chart, Decision Matrix, Two-Axis Comparison)	● List of required functions ● Preliminary design selection ● Criteria, constraints, and metrics

Phase 3: Design Optimization

Inputs	*Tasks*	*Outputs*
• Preliminary design selection • Prioritized criteria, constraints, metrics, stakeholders • List of required functions	• **Develop Prototype** • **Optimize: Build, Test, Verify, Refine** (simulation, inquiry)	• Detailed final design (drawing, model, explanation, etc.) • Functional prototype • Performance specifications from testing, modeling, etc. to show how well design/ prototype meets criteria/ constraints/ functions

Phase 4: Communicate Solution

Inputs	*Tasks*	*Outputs*

• Detailed Final Design	• **Document the final design**
	• **Prepare a report and/or presentation for stakeholders**
		• Technical Report possibly including:
		  ○ Technical drawings and design details
		  ○ Fabrication specifications
		• Final Presentation
		(Students should be aware of desired audience and outcome of the specific type of product requested.)