

Introduction to Engineering

UNIT/ Weeks	Timeline/Topics	Essential Questions
3.5	The Design Process <ul style="list-style-type: none"> • How to approach problems • Developing solutions to a problem • The brainstorming process • Graphical representation of ideas 	<ul style="list-style-type: none"> • When solving an engineering problem, how can we be reasonably sure that we have created the BEST solution possible? • What is the evidence? • What is the most effective way to generate potential solutions to a problem? • How many alternate solutions are necessary to ensure a good final solution?
3.5	Technical Sketching and Drawing <ul style="list-style-type: none"> • Technical Sketching • Technical Drawing 	<ul style="list-style-type: none"> • How is technical drawing similar to and different from artistic drawing? • What can cause a technical drawing to be misinterpreted or to be inadequate when conveying the intent of a design to someone unfamiliar with the original problem or solution? • In what ways can technical drawings help or hinder the communication of problem solution in a global community? • Strong spatial-visualization skills have been linked to success in engineering. Why are spatial-visualization skills so important to engineering success?
3.5	Measurement and Statistics <ul style="list-style-type: none"> • English and Metric Measurement • Measurement Conversions • Precision Measurements • Dimensioning Techniques • Statistical Analysis 	<ul style="list-style-type: none"> • Why is error unavoidable when making a measurement? • What would happen if engineers did not follow accepted dimensioning standards and guidelines but, instead, used their own individual dimensioning methods? • When recording measurement data, why is the use of significant figures important?
3.5	Modeling Skills <ul style="list-style-type: none"> • Engineering Graphics • Mathematical Modeling • Software Modeling 	<ul style="list-style-type: none"> • How should one decide what information and/or artifacts to include in a portfolio? Should a portfolio always include documentation on the complete design process? • Did you use every possible type of model during the design and construction of your puzzle cube? Describe each model that you used? • How reliable is a mathematical model?
3.5	Geometry of Design <ul style="list-style-type: none"> • Calculating Physical Properties • Geometric Constraints • CAD Modeling Skills 	<ul style="list-style-type: none"> • What advantage(s) do Computer Aided Design (CAD) and Drafting provide over traditional paper and pencil design? What advantages does paper and pencil design provide over CAD? • Which high school math topic/course, Algebra or Geometry, is more closely related to engineering? Justify your answer.

		<ul style="list-style-type: none"> • How does the material chosen for a product impact the design of the product?
3.5	<p>Reverse Engineering</p> <ul style="list-style-type: none"> • Visual Design Principles • Visual Analysis • Functional Analysis • Structural Analysis 	<ul style="list-style-type: none"> • Why are many consumer product designs not commercially successful? • When, if ever, is it acceptable for a company to reverse engineer and reproduce a successful consumer product designed by another person/company?
4	<p>Documentation</p> <ul style="list-style-type: none"> • More Dimensioning Procedure • Sectional Views Procedure • Tolerances Procedure • Assembly Models Procedure • Engineering Documentation • Design Brief • Product Enhancement 	<ul style="list-style-type: none"> • What are the consequences to the final solution if the design problem is poorly communicated? • How does one know that a given design solution is the best possible solution? • Engineering is described as the application of math, science and technology to solve problems. Does this description imply that designing an enhancement to an Automoblox vehicle is the work of an engineer? Justify your answer. • What quality makes a set of drawings sufficient to adequately represent the design intent? • Is it always necessary to indicate a tolerance for every dimension on a technical drawing? Justify your answer. • Stephen Covey includes Begin with the End in Mind as one of the seven habits listed in his book The 7 Habits of Highly Effective People. How can this habit make an engineer more effective?
3.5	<p>Advanced Computer Modeling</p> <ul style="list-style-type: none"> • Parametric Modeling • Automata Design Challenge • Instant Air Challenge: Air Vehicle 	<ul style="list-style-type: none"> • Are working drawings always necessary in order to communicate the design of a consumer product? Justify your answer. • Animated assemblies are not typically included as part of the technical documentation of a design. How can 3D animated assembly models of an object or a proposed design be used in the design process? Beyond the design process?
3.5	<p>Design Team</p> <ul style="list-style-type: none"> • Product Lifecycle • Engineering Design Ethics Design Brief • Virtual Design Challenge • Team Norms • Product Research Documentation 	<ul style="list-style-type: none"> • Is it ever advantageous to create a design or solve a problem individually as opposed to using a team approach? Explain. • What strategy would you use to form a design team in order to obtain the best solution possible? • What does it mean to be “ethical” in your work? Do engineers need to be taught to be “ethical”? • It has been said that, “Having a vision without action is a daydream; Taking action without a vision is

		a nightmare!" How does this apply to engineering design?
4	<p>Design Challenges</p> <ul style="list-style-type: none">• Assessing a Problem• Considering Prototypes• Applying the Decision Matrix• Marketing Products	<ul style="list-style-type: none">• Engineering has been referred to as the "stealth" profession. Do you think this is an appropriate label? Explain.• If you had to describe one strategy that would most help an engineer be a good and effective designer, what would it be?