Meaning
***Essential Questions**: Students will keep considering…* • EQ2.1 How is a design process used to effectively develop a design solution that solves a problem or addresses a design opportunity? • EQ2.2 Why would a designer choose to communicate a solid object design with two-dimensional sketches rather than a three-dimensional model. • EQ2.3 How has the evolution of rapid prototyping tools impacted design fabrication? • EQ2.4 How is design testing data used to improve design solutions? • EQ2.5 How does using a CAD application benefit an engineer? • EQ2.6 Why is it important for an engineer to be aware of the criteria and the constraints when designing a project? • EQ2.7 How does documentation play a critical role in each step of the design process? • EQ2.8 How can mathematical modeling help designers understand a design? • EQ2.9 How can computational thinking be applied when developing an engineering solution? • EQ2.10 What is the role of statistical analysis in the design process?

Meaning	*Acquisition*	
Domains/Understandings *Domains are key understandings and long-term takeaways that go beyond factual knowledge into broader and more conceptual comprehensions.* *Domains are areas of expertise that an employer in a specific field may seek.* ***"I will be able to address real-world challenges because I understand…"***	***Transfers/Learning Objectives*** *Objectives articulate what skills students need to be able to do. (The learning objectives will become targets of assessment.)* *Objectives are functions that directly relate to the workplace or in an applied academic setting.* ***"In the workplace or academic setting, I will need to know and be able to…"***	***Knowledge and Skills*** *Knowledge and skills include the essential facts and basic concepts that a student should know and be able to recall in order to perform the competency.* *Knowledge and skill statements are foundational to the performance of a skill.* ***"After I learn the information, I will be able to use my knowledge and skills to…"***
D1.1: Mindset Ethics, analytical thinking, creativity, persistence, iteration, and the positive role of failure are important	LO1.1A: Describe and/or analyze moments within a problem solving process where persistence, iteration, and the positive aspect of failure played an important	KS1.1A1: Understand that problem solving and experimentation are cyclical, meaning steps are repeated as many times as needed.

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mindsets and habits of action. They are developed over time in problem solving processes, inquiry, and computational thinking.	role in gaining understanding about a problem or unexpected observation.	KS1.1A2: Recognize that identifying complex problems, defining them clearly, and proposing solutions can be difficult and requires persistence and iteration. KS1.1A3: Describe how failure can produce positive outcomes by improving understanding.
	LO1.1C: Analyze problems or artifacts when developing solutions.	KS1.1C1: Demonstrate analytical thinking when evaluating a proposed solution, locating and correcting errors, explaining how something functions, gaining understanding through experimentation, and/or justifying the appropriateness of a solution, model, or artifact.
	LO1.1E: Recognize that models are used to make predictions and/or learn about a phenomenon, situation, or design.	KS1.1E1: Identify various models that may be used, which include but are not limited to physical models (prototypes), mathematical models, simulations, schematics, code, and 3D and 2D representations. KS1.1E2: Compare and contrast the various types of models used when designing a solution.
D1.2: Problem Solving Process and/or Design Process Many disciplines, including engineering, computer science, and biomedical science, use an iterative problem solving process or engineering design process.	LO1.2A: Apply an iterative process to solve a problem or create an opportunity that can be justified.	KS1.2A3: Recognize that all solution attempts should be realistic and based on identified design requirements, which include specifications, constraints, desired features, and testable parameters.
D1.3: Computational Thinking Computational thinking is used to solve problems or create solutions based on an identified need or an opportunity. Common concepts of computational thinking include: the use of algorithms, abstraction, problem decomposition, and data analysis and processing. Computational thinking can support solving problems across many disciplines including math, science, humanities, engineering, and computer science.	LO1.3A: Apply computational thinking to solve problems.	KS1.3A1: Recognize that computational thinking can be applied in all domains. KS1.3A3: Apply logical reasoning by organizing the steps of an algorithm into the correct sequence. KS1.3A4: Understand that different algorithms can be used to solve the same problem.
D2.1: Modeling Designing and creating models are essential to the engineering design and problem solving processes.	LO2.1A: Apply a mathematical model to represent an authentic situation.	KS2.1A1: Recognize that mathematical equations can be used to create models through tables, charts, and simulations.

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Models are used to represent an artifact or a system to better understand its attributes and/or behavior. Models can be physical, mathematical, computer-generated, and/or simulated.	LO2.1C: Construct a computer-generated solid model.	KS2.1C1: Develop solid models using two-dimensional geometric shapes and three-dimensional geometric primitives. KS2.1C2: Construct new solid models using geometric primitives with additive and subtractive methods. KS2.1C3: Apply geometric and dimensional constraints to solid model designs.
	LO2.1D: Create a physical model or prototype.	KS2.1D1: Construct a prototype based on design documentation. KS2.1D2: Conduct prototype testing to identify design flaws or additional needs. KS2.1D3: Analyze and interpret testing data collected and make modifications to optimize the design or process.
D2.2: Measurement and Estimation A common measurement system is essential to design accuracy for sketches, models, and prototypes. Measuring and dimensioning objects using appropriate tools are critical to effectively communicate and collaborate on design solutions.	LO2.2A: Measure and present values appropriate to standards of accuracy and precision.	KS2.2A1: Identify the proper tool to use to measure and dimension with accuracy and precision. KS2.2A2: Identify the appropriate equation for area and volume problems.
D2.3: Spatial Visualization Sketching allows designers to quickly communicate ideas with accurate dimensions and details. Using technology, two-dimensional sketches can be represented in a three-dimensional solid model. Solid models allow designers to view multiple aspects and perspectives of a design.	LO2.3A: Translate and interoperate between 2D and 3D design representations.	KS2.3A1: Differentiate between two-dimensional and three-dimensional models including the strengths and limitations of each. KS2.3A2: Interpret multiview drawings, specifications, dimensions, and annotations.
	LO2.3B: Sketch and/or interpret perspective, isometric, and multiview drawings with adequate attention to standards and critical annotations.	KS2.3B3: Summarize the reasoning for using sketching as a communication tool. KS2.3B4: Apply dimensions on a multiview sketch following the guidelines of dimensioning. KS2.3B5: Create a rapid, accurate sketch to communicate ideas.

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D2.4 Tools and Technology There are a variety of tools and technology used during the different stages of an engineering design or problem-solving process. They include, but are not limited to, measuring tools, drawing tools, software applications including computer-aided design (CAD), computer algebra system (CAS) applications, modeling and simulation, data representation, and online resources.	LO2.4A: Select and apply tools and technology appropriately to develop solutions, create artifacts, and/or conduct investigations into engineering, biomedical science, and computational problems/needs.	KS2.4A1: Recognize the existence of various tools and technology that can be used when developing solutions or artifacts or conducting experiments. KS2.4A2: Select the appropriate tools and technology based on the needs of the project and the team.
D3.1 Collaboration Effective problem solving, experimentation, and/or design are most often conducted within teams.	LO3.1A: Collaborate effectively on a diverse and multi-disciplinary team.	KS3.1A1: Describe how diverse perspectives in collaboration typically produce the best results in a process. KS3.1A4: Apply team norms to encourage productivity and define how a team will function and measure its success.
D3.2: Communication Communication can often be categorized as technical communication or professional communication.	LO3.2A: Communicate effectively for specific purposes and settings.	KS3.2A3: Demonstrate best practices that are widely accepted by professionals when they communicate such as how to present visual media, oral presentations, and professional correspondence.
	LO3.2C: Construct and communicate informed decisions supported by evidence.	KS3.2C2: Use current and accurate research and testing documentation.

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