Unit	Topic	Lesson	Lesson Objectives
Engineering Design II			
	Course Overview		
		Introduction	
			Describe the goal of the course
			Describe the types of jobs that use engineering design skills
			List tips for achieving academic success in the course
		Start the Course	
			Identify computer requirements
			Learn how to move through the course
			Switch between windows
		Set Up Your Computer	
			Find files and folders on a computer
			Set up a computer to show the List folder view and file name extensions
			Make a course folder
		Set Up a Browser and Install Software	
			Set up a web browser
			Download and install a zip utility
			Zip and unzip files and folders
			Download and unzip course resources
			Install software
		Research and Citation	
			Identify sources of trustworthy information
			Define plagiarism and citation
	The Design Process		
		Explore Design and Documentation	
			Identify and describe the stages of the design process
			Define engineering notebook
			Identify common contents and types of engineering notebooks
			Describe reasons for using engineering notebooks
			Describe common standards for engineering notebook content

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		Define the Problem	
			Create an engineering notebook
			Describe stage 1 of the design process: define the problem
			Identify engineering notebook standards for use in the class
			Select a design challenge
			Create an entry in the engineering notebook
		Think of Possible Solutions	
			Describe stage 2 of the design process: think of possible solutions
			Identify common brainstorming guidelines, and use brainstorming to create a list of possible solutions
			Describe the purpose of research and common research resources
			Use Google to research aspects of a design challenge
			Describe the purpose of citation in an engineering notebook, and cite a source in an engineering notebook
		Select a Solution	
			Describe stage 3 of the design process: select a solution
			Describe the contents of a design brief, and create a design brief
			Define requirements and constraints
			Identify the requirements and constraints of a design challenge
			Select a solution
		Create a Plan	
			Describe stage 4 of the design process: create a plan
			Define and describe the purpose of a design proposal
			Create a design proposal for a solution to a design challenge
		Build the Design	
			Describe stage 5 of the design process: build the design
			Define prototype and model
			Build a design for a design challenge

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		Test the Solution	
			Describe stage 6 of the design process: test the solution
			Test a design for a design challenge and evaluate the success of a design
			Refine a design
			Define and describe the purpose of a final design document
			Create a final design document
	Simple 3-D Objects		
		Draw Lines and Shapes	
			Open Creo™ Elements/Direct™ Modeling Personal Edition
			Define workplane
			Use the Line/Arc, Rectangle, and Circle tools to draw lines and shapes
			Use the Delete 2D tool to delete lines and shapes
		Create a 3-D Object	
			Define shape and profile
			Use the Move/Stretch tool and reference points to edit lines and shapes
			Use the Linear Pull Profile tool to pull a profile to create a 3-D object
			View a 3-D model from many angles
		Create Objects of Specific Sizes	
			Draw lines to specific dimensions and at specific angles
			Draw arcs, rectangles, and circles of specific sizes
			Rotate a profile
			Pull a profile to a specific height
		Create 3-D Forms	
			Define part
			Use the Delete 3D tool to delete 3-D objects
			Use the structure part to hide or delete parts
			Define form
			Create simple 3-D objects such as a box, cube, and cylinder

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	Using Geometry		
		Make a Cone and Sphere	
			Create a workplane
			Define geometry, and draw parallel and perpendicular lines
			Use the Pull Angular tool to revolve a shape around an axis to create a 3-D object
			Create a cone and a sphere
			Define tangent, and use tangents to draw arcs
		Make a Cup	
			Add a workplane on a face and set active workplanes
			Define additive and subtractive processes
			Describe how any object can be considered the result of additive and subtractive processes
			Use additive and subtractive processes to create a CAD model
			Use the Punch tool to create a hole through a 3-D object
		Edit Parts	
			Use the Stretch tool to modify a part
			Pull, push, and revolve faces
			Use the Distance tool to measure parts
			Edit parts to a specific size
			Move and position parts in 3-D space
		Calculate Area, Surface Area, and Volume	
			Define area, evaluate formulas involving exponents, and identify formulas for the area of a rectangle, triangle, and circle
			Calculate the area of simple geometric shapes, and define surface area
			Use order of operations and rounding to evaluate formulas
			Define volume, identify formulas for the volume and surface area of a box, cylinder, and sphere, and calculate the surface area of simple 3-D forms
			Use CAD to calculate areas of faces, surface areas of objects, and volumes of objects

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	Drawings and Dimensions		
		Create a Three-View Orthographic Drawing	
			Load a part and choose the front view of a 3-D object
			Use CAD to create a three-view orthographic drawing
			Use the Scale tool to change the size of views in a CAD drawing
			Define and use the Annotation window
			Use the Update tool to update a drawing and use the Move tool to move and arrange views on a drawing
		Prepare for Dimensioning	
			Describe common line types used in dimensioning
			Describe common dimensioning guidelines
			Change the unit of measurement for the 3-D view and the Annotation window
		Dimension a Drawing	
			Use the Single tool to dimension a drawing
			Specify the orientation of a dimension
			Use the Delete tool to delete dimensions
			Use the Datum Long tool to add baseline dimensions to a drawing
			Use the Move Dim tool to move and arrange dimensions on a drawing
		Dimension Features	
			Use the Diameter tool to dimension a hole
			Define fillet and round, and use the Create Constant Radius Blend tool to create fillets and rounds
			Use the Radius tool to dimension a fillet and a round
			Define chamfer, use the Create Constant Distance Chamfer tool to create a chamfer, and then dimension a chamfer
			Remove fillets, rounds, and chamfers
		Use Tolerance	
			Define tolerance
			Define limit dimensions and use them to dimension a drawing
			Define bilateral tolerance and use it in dimensioning a drawing
			Define unilateral tolerance and use it in dimensioning a drawing
			Define general tolerance

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	Product Analysis		
		Choose a Product	
			Define product analysis
			Define disassemble and disassembly
			Choose a product to analyze
		Explore Visual Design	
			Define visual design and visual appeal
			Define aesthetics
			Describe the impact of visual design on a product's marketability
			Identify and describe the elements of visual design, including line, shape, form, color, value, space, and texture
			Identify and describe the principles of visual design, including repetition, pattern, contrast, variety, rhythm, movement, balance, emphasis, dominance, proportion, alignment, proximity, unity, and harmony
		Analyze Visual Design	
			Define aesthetic vocabulary
			Do a visual design analysis of a product
			Define marketing, market segment, and demographics
			Define advertising and advertisements
			Define packaging and describe its role in marketability
		Explore Reverse Engineering	
			Define reverse engineering, describe common reasons for reverse engineering, and identify the stages in reverse engineering
			Describe stage 1 of the reverse engineering process: identify the purpose, and identify the purpose of a reverse engineering project
			Describe stage 2 of the reverse engineering process: develop hypotheses, and develop hypotheses for a reverse engineering project
			Describe stage 3 of the reverse engineering process: disassembly
			Define joinery, fastener, thermal bonding, and adhesive Describe common tools and safety rules used during a disassembly process, and then do a pre-disassembly analysis

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		Analyze Function and Structure	
			Describe stage 4 of the reverse engineering process: focused analysis
			Identify common types of analyses, including functional, structural, materials, and manufacturing
			Define systems thinking, input, process, and output
			Define mechanical part and electrical part
			Do a functional analysis and a structural analysis on a product
		Analyze Materials and Manufacturing	
			Define material type and identify common material types
			Define material property and identify common material properties such as mechanical, electrical, thermal, chemical, optical, and acoustical
			Do a materials analysis on a product
			Describe common manufacturing methods, including forming, separation, and joining
			Do a manufacturing analysis on a product
		Propose a Redesign	
			Describe stage 5 of the reverse engineering process: prepare the report
			Prepare a report documenting a reverse engineering project
			Describe stage 6 of the reverse engineering process: redesign
			Create a redesign proposal based on product analysis
	Green Engineering Design		
		Explore Sustainability	
			Define the environment, natural resource, renewable resource, and non-renewable resource
			Define economy and economics
			Describe the impact of human products on the environment, including resource depletion, deforestation, habitat loss, pollution, and waste
			Define ecological design, green design, and sustainability
			List the characteristics of sustainability

Unit	Topic	Lesson	Lesson Objectives
		Explore Ecological Design	
			Define life cycle, and describe the five stages of a product's life cycle
			Define and describe reducing, reusing, and recycling
			Identify ecological design considerations such as what a product is made of, how it's made, additional resources required to make it, and how it's used
			Identify and describe the purpose of the Environmental Protection Agency (EPA), the Food and Drug Administration (FDA), and the Consumer Product Safety Commission (CPSC)
			Describe the relationship between marketability, cost, and ecological design