Introduction to Engineering Design

Michigan Grades 9-12 Technology Standards - Linked

Unit	Objective	TECHNOLOGY GRADES 9-12: http://www.michigan.gov/documents/9-12_150927_7.pdf	BASIC OPERATIONS AND CONCEPTS	BOC3. understand the importance of both the predictable and unpredictable impacts of technology	SOCIAL, ETHICAL, AND HUMAN ISSUES	SEHI1. explore career opportunities and identify their related technology skill requirements	SEHI2. design and implement a personal learning plan that includes technology to support his/her lifelong learning goals	TECHNOLOGY PRODUCTIVITY TOOLS	TPT5. identify technology tools (e.g., authoring tools or other hardware and software resources) that could be used to create a group project	TPT8. Use a variety of applications to plan, create, and edit a multimedia product (e.g., model, webcast, presentation,	TPT9. have the opportunity to participate in real-life experiences associated with technology-related careers	TECHNOLOGY COMMUNICATIONS TOOLS	TCT2. use available technologies (e.g., desktop conferencing, e-mail, groupware, instantmessaging) to communicate with others on a class assignment or project	TCT3. use a variety of media and formats to design, develop, publish, and present products (e.g., presentations, newsletters, web sites) to communicate original ideas to multiple audiences	TCT4. collaborate in content-related projects that integrate a variety of media (e.g., print, audio, video, graphic, simulations, and models) with presentation, word processing, publishing, database, graphics design, or spreadsheet applications	TCT5. plan and implement a collaborative project using telecommunications tools (e.g., groupware, interactive web sites, videoconferencing)	TECHNOLOGY RESEARCH TOOLS	TRT2. formulate and use evaluation criteria (authority, accuracy, relevancy, timeliness) for information located on the internet to present research fi ndings	TECHNOLOGY PROBLEM-SOLVING AND DECISION-MAKING TOOLS	TPSDMT1. use a variety of technology resources (e.g., educational software, simulations, models) for problem solving and independent learning
Unit 1 Overview	Students will develop an appreciation of how the history of art has influenced innovations in the field of enginee																			
	Students will research how artistic period and style have influenced product and architectural design.																			
	Students will explore the design concept of form and function and explain its use in product design.																			
	Students will explore the evolution of technology and be able to identify engineering achievements through hist	x	x	x																
	Students will research the chronological development and accelerating rate of change that innovations in tools a	x						x	x											
	Students will review the history of measurement tools and identify two innovations that have led to improved fur																			
	Students will explore a given professional organization and summarize in a short PowerPoint presentation the r	x										x		x						
	Students will identify career opportunities in design engineering and explain their job functions.	x			x	x														
	Students will explore career opportunities in a given engineering field and list the educational requirements for e	x			x	x														
Unit 11 Production	Students will recognize the need to involve all of the manufacturing team members in the decision making proc	x										x			x					
	Students will be able to categorize manufacturing specifications and constraints needed to produce a product.																			
	Students will be able to evaluate material characteristics for manufacturing a specific product and identify the co																			
	Students will evaluate and apply the correct machine process.	x	x	x																
	Students will recognize the need to limit the number of processes used to manufacture a product.																			
	Students will develop an understanding of process routing.																			
	Students will distinguish the differences between CNC, FMS, and CIM.																			
	Students will explain the need for a company to minimize material handling by procurement of materials in a tim																			
	Students will identify the need to perform a cost analysis of a product.																			
	Students will interpret data, which has been statically analyzed, to ensure product quality.																			
	Students will identify the need to evaluate the areas of manpower and facility requirements.																			
	Students will recognize the need to protect a product for shipping.																			
	Students will analyze aesthetic requirements to enhance packaging for the consumer.																			
Unit 3 Student Portfolio	Students will identify the proper elements of a fully developed portfolio.																			
	Students will identify and discuss the ethical issues surrounding portfolio artifacts.																			
	Students will compare and contrast defined elements of a good portfolio specified in the PowerPoint presentatio																			
	Students will develop a portfolio to organize and display evidence of their work.																			
Unit 5 Geometric Relationships	Students will define and contrast points, lines and line segments.																			
	Students will identify major geometric shapes (isosceles triangle, right triangle, scalene triangle, rectangles, squ																			
	Using a compass, ruler and triangle students will construct various geometric shapes.																			
	Students will define the elements and types of angles.																			
	Using a compass, ruler and triangle students will construct and bisect various types of angles.																			
	Students will define terminology associated with arcs and circles.																			
	Using a compass, ruler and triangle students will construct arcs, circles and ellipses.																			
	Students will distinguish and define geometric constraints.																			
	Students will identify the following geometric constraints in given three-dimensional models: horizontal, vertical,																			
	Students will apply the right hand rule to identify the X, Y, and Z axes of the Cartesian Coordinate System.																			
	Students will apply a combination of absolute, relative, and polar coordinates to construct a three-dimensional r																			
	Students will define the origin planes in the Cartesian Coordinate System.																			
	Students will identify the origin and planar orientations of each side of a three-dimensional model.																			
Unit 10 Presentation	Students will demonstrate the following communication techniques: voice variation, eye contact, posture, attire,																			
	Students will have an understanding of various forms of visual aids and when to use them in a presentation.	x										x		x	x					
	Considering the audience and level of formality, students will select the most appropriate type of visual aid for a	x										x		x						
	Considering the audience and level of formality, students will select the most appropriate type of written docume	x										x			x					
	Students will identify the elements of the various forms of written documentation.																			
Unit 12 Marketing	Students will define, explain, and demonstrate an understanding of common vocabulary words used in associat																			
	Students will formulate a product cost analysis for a given product.																			
	Students will demonstrate an understanding of packaging design requirements.																			
	Students will design a package for a given product.																			
Unit 2 Introduction To Design	Students will list the seven steps of the design process and explain the activities that occur during each phase.																			
	Students will assess the value of working as a team and understand the benefits of collaboration.	x										x			x	x				
	Students will realize the importance of focusing on detail when executing the design process.																			
	Students will apply the steps of the design process to solve a variety of design problems.																			
	Students will investigate the principles and elements of design and demonstrate their use in the design process																			
	Students will identify the use of the principles and elements of design in various products, print media, and art fo	x										x			x					
	Students will express their understanding of the principles and elements of design by incorporating them in des	x			x		x					x		x	x					
	Students will collect and display examples of the application of the principles and elements of design utilized in	x										x			x					
Unit 4 Sketching and Visuals	Students will integrate proper sketching techniques and styles in the creation of sketches.																			
	Students will demonstrate the ability to produce two-dimensional geometric figures.																			
	Students will select and produce the appropriate pictorial style to best communicate solutions in the design proc	x										x		x						
	Students will formulate pictorial sketches to develop ideas, solve problems, and understand relationships during																			
	Students will create sketches utilizing both the additive and subtractive methods to assess underlying geometric																			
	The student will select a sketching method that is efficient in its use of color, form, and symbols representing ab																			
	Students will augment pictorial sketches with shading to improve communication.	x						x		x		x		x						
	Students will evaluate and select the necessary views to graphically communicate design solutions.	x										x			x					
	Students will interpret annotated sketches in the design analysis process.	x										x		x						
	Students will integrate annotated sketches in presentations, portfolio, and documentation process.	x						x		x		x		x	x					
	Students will develop properly annotated sketches to accurately convey data in a design solution.																			
Unit 6 Modeling	Students will experience the creative thinking process.																			
	Students will recognize the difference between vertical and lateral thinking.																			
	Students will categorize and select a solution to a problem.																			
	Students will communicate their idea through written and verbal formats.	x						x				x	x	x						
	Students will identify the different graphical method of data representation.																			
	Students will select the appropriate graphical format to a problem.																			
	Students will analyze and develop graphical representation of given data.																			
	Students will have an understanding of the different physical modeling techniques.																			
	Students will present a model with its correct proportions.																			
	Students will select the appropriate modeling materials to complete a three-dimensional model.																			
	Students will evaluate a problem using mathematical formulae.																			
	Student will analyze a solution to a problem using the correct format of analysis.																			
	Students will interpret a sketch and generate a model using a computer and a CAD software package.	x						x	x										x	x
	Students will explain the difference between parametric and adaptive designs and be able to specify their uses.																			
	Students will draw a two-dimensional sketch using a CAD package.	x						x	x			x			x					
	Students will apply geometrical and dimensional constraints to a sketch.																			
	Students will demonstrate the ability to generate a three-dimensional model.	x															x			x
	Students will understand and demonstrate the use of work features and how they are applied while constructing	x																	x	x
	Students will recognize the use and need of work planes, axes, and points in the development of a computer m	x																	x	x
	Students will demonstrate the ability to modify a sketch or feature of a model.	x																	x	x
Unit 7 Assembly Modeling	Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.																			
	Students will place and create components in the assembly modeling environment.	x						x			x									
	Students will create circular and rectangular patterns of components within an assembly model.	x						x			x									
	Students will replace components with modified external parts.	x						x			x									
	Students will perform part manipulation during the creation of an assembly model.	x						x			x									
	Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.	x						x			x									
	Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.	x						x			x									
	Students will perform part manipulation during the creation of an assembly model.	x						x			x									
	Students will apply assembly constraints to successfully construct a multi-part object.	x						x			x									
	Students will utilize part libraries effectively during the assembly modeling process.	x						x			x									
	Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.	x						x			x									
	Students will employ sub-assemblies during the production of assemblies.	x						x			x									
	Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.	x						x			x									
	Students will understand and apply drive constraints to simulate the motion of parts in assemblies.	x						x			x									
	Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.	x						x			x									
	Students will explore, understand, and apply adaptive design concepts during the development of sketches, fea	x																	x	x
	Students will explore and demonstrate assembly modeling skills to solve a variety of design problems.	x						x			x									
Unit 8 Modeling Analysis	Students will demonstrate how to extract mass properties data from their solid models.																			
	Students will evaluate the accuracy of mass properties calculations.	x															x	x		
	Students will describe how analysis data can be used to update parametric models.																			
	Students will list and explain the various mass property calculations, such as, volume, density, mass, surface ar																			
	Students will interpret and use correct tolerancing techniques when dimensioning solid models.																			
	Students will understand and solve tolerance problems, including limits and fits.																			
	Students will understand the differences between clearance fit, interference fit, and allowance.																			
Unit 9 Model Documentation	Students will select the appropriate sheet size and title block for creating a drawing layout.	x										x		x	x					
	Students will translate a three-dimensional drawing or model into corresponding orthographic drawing views.																			
	Students will describe the purpose, and/or application, of the following drawing views: isometric view, section vi																			
	Students will generate an isometric view from orthographic drawing views.	x																	x	x
	Students will determine the correct application for the various section views required to illustrate an object™s ir																			
	Students will describe the purpose and application of hatch marks and a cutting plane line, as used in a section																			
	Students will create the appropriate section view for a specified application.																			
	Students will create a detail view that corresponds to the appropriate orthographic drawing view.	x																	x	x
	Students will create an auxiliary view to show the detail on an inclined surface of a drawing object.	x																	x	x
	Students will list the common dimensioning standards.																			
	Students will identify and demonstrate the use of common dimensioning systems.																			
	Students will describe the characteristics and demonstrate the use of unidirectional and aligned dimensioning.																			
	Students will differentiate the use of and demonstrate an understanding of size and location dimensions by app																			
	Students will demonstrate appropriate dimensioning rules and practices.																			
	Students will set up and integrate the use of a customized common dimensioning standard.																			
	Students will identify and demonstrate the use of dimensioning practices on section, auxiliary, and assembly mo																			
	Students will define and demonstrate an understanding of tolerancing, and solve tolerance problems.																			
	Students will apply appropriate annotations on sketches and drawings.																			
	Students will understand and formulate general and proprietary specifications to further communicate informatio																			