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Knowledge	Skills	Performance Element		Technical Standards - Michigan Customized List
III				**Engineering Graphical Communication**
	A			**Create and assemble a prototype using CAD modeling software.**
		1		Brainstorm and sketch possible solutions to an existing design problem.
		2		Select an approach that meets or satisfies the constraints given in a design brief.
		3		Create simple extruded solid Computer Aided Design (CAD) models from dimensioned sketches.
		4		Generate dimensioned multiview drawings from simple CAD models.
		5		Measure and Fabricate parts for a functional prototype from the CAD multiview drawings.
		6		Assemble the product using the CAD modeling software.
		7		Test and evaluate the prototype and record results.
		8		Apply geometric and numeric constraints to CAD sketches.
		9		Identify the purpose of packaging in the design of consumer products.
	B			**Demonstrate an understanding of mathematics and dimensioning associated with CAD design software.**
		1		Identify common geometric shapes and forms by name.
		2		Calculate the area of simple geometric shapes.
		3		Calculate the surface area and volume of simple geometric forms.
		4		Identify and explain the various geometric relationships that exist between the elements of two-dimensional shapes and three-dimensional forms.
		5		Identify and define the axes, planes, and sign conventions associated with the Cartesian coordinate system.
		6		Apply geometric and numeric constraints to CAD sketches.
		7		Utilize sketch-based, work reference, and placed features to develop solid CAD models from dimensioned drawings.

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Knowledge	Skills	Performance Element		
				Technical Standards - Michigan Customized List
		8		Explain how a given object's geometry is the result of sequential additive and subtractive processes.
		9		Explain the differences between size and location dimensions.
		10		Differentiate between datum dimensioning and chain dimensioning.
		11		Identify and dimension fillets, rounds, diameters, chamfers, holes, slots, and screw threads in orthographic projection drawings.
		12		Explain the rules that are associated with the application of dimensions to multiview drawings.
	C			**Demonstrate an understanding of tolerances and their implications on an engineering design.**
		1		Identify, sketch, and explain the difference between general tolerances, limit dimensions, unilateral, and bilateral tolerances.
		2		Differentiate between clearance and interference fits.
		3		Sketch and model an auxiliary view of a given object to communicate the true size and shape of its inclined surface.
		4		Describe the purpose and demonstrate the application of section lines and cutting plane lines in a section view drawing.
		5		Sketch a full and half section view of a given object to communicate its interior features.
		6		Identify algebraic relationships between the dimensional values of a given object.
X				**TECHNICAL SKILLS**
	B			**Develop processes and concepts for the use of technology which model technical competence.**
		1		Use and calibrate probes, sensors, measuring systems, and devices to collect data using traceable standards.
		2		Explain the impact of error in measurement, predict the effect of error propagation in calculations, and record data with the correct number of significant digits.

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Knowledge	Skills	Performance Element		
				Technical Standards - Michigan Customized List
		3		Safely operate a variety of tools, machines, and equipment (e.g. milling machines, rapid prototyping machines, drill press, band saw, CNC machines, and hand tools).
		4		Use, handle, and store tools and materials correctly, perform preventative maintenance, understanding the results of negligence and improper maintenance or improper calibration.
XI				**DESIGN**
	B			**Apply active listening skills to obtain or clarify information pertaining to plans, processes, projects, or designs.**
		1		Interpret messages or information provided that clarifies issues, ideas, plans, projects, or processes.
			a	Indicate familiarity of topic being presented.
			b	Respond accordingly using appropriate verbal and nonverbal language.
			c	Answer questions correctly and be able to provide feedback in own words.
		2		Respond and/or restate information that will clarify STEM techniques to be used and/or information to be applied to projects, plans, or processes.
			a	Ask questions to seek or confirm understanding.
			b	Paraphrase and/or repeat information.
			c	Record notes and summarize information from written notes.
I				**ACADEMIC FOUNDATIONS:** ***Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.***
	C			**Demonstrate mathematics knowledge and skills required to pursue the full range of post-secondary education and career opportunities.**
		1		Identify whole numbers, decimals, and fractions.
		2		Demonstrate knowledge of basic arithmetic operations such as addition, subtraction, multiplication, and division.

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Knowledge	Skills	Performance Element		
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		3		Demonstrate use of relational expressions such as equal to, not equal, greater than, less than, etc.
		4		Apply data and measurements to solve a problem.
		5		Analyze mathematical problem statements for missing and/or irrelevant data.
		6		Construct charts/tables/graphs from functions and data.
		7		Analyze data when interpreting operational documents.
	D			**Demonstrate science knowledge and skills required to pursue the full range of post-secondary and career education opportunities.**
		1		Evaluate scientific constructs including conclusions, conflicting data, controls, data, inferences, limitations, questions, sources of errors, and variables.
III				**PROBLEM-SOLVING AND CRITICAL THINKING:** ***Solve problems using critical thinking skills (analyze, synthesize, and evaluate) independently and in teams. Solve problems using creativity and innovation.***
	G			**Employ spreadsheet applications to organize and manipulate data.**
		1		Create a spreadsheet.
		2		Perform calculations and analyses on data using a spreadsheet.
	H			**Employ database applications to manage data.**
		1		Manipulate data elements.
		2		Manage interrelated data elements.
		3		Analyze interrelated data elements.
		4		Generate reports showing interrelated data elements.
	B			**Implement quality control systems and practices to ensure quality products and services.**
		1		Describe quality control standards and practices common to the workplace.
				MICHIGAN CAREER AND EMPLOYABILITY STANDARDS

Knowledge	Skills	Performance Element		15.0000 Engineering, General (2011)
				Technical Standards - Michigan Customized List
I				**APPLIED ACADEMIC SKILLS**
	F			**Technology Operations and Concepts - By the end of Grade 12 each student will:**
		1		Complete at least one online credit, or non-credit, course or online learning experience
		2		Use an online tutorial and discuss the benefits and disadvantages of this method of learning