

**IB Subject Group: Design**

**Course: Foundations of Computer Science**

**Year: 4/5**

Unit title	Key concept	Related concept(s)	Global context	Statement of Inquiry	Objectives	ATL skills	Content
Human Computer Interaction	Communication	Adaptation, Function	Scientific and Technical Innovation	Scientific and Technical Innovation can influence how computer applications are used in order to communicate ideas to various audiences.	Criterion A: i-iv	Communication I. Communication Social II. Collaboration Self-Management	<ul style="list-style-type: none"> <li>• Analyze the characteristics of hardware components to determine the applications for which they can be used.</li> <li>• Use appropriate tools and methods to execute Internet searches that yield requested data.</li> <li>• Evaluate the results of web searches and the reliability of information found on the Internet.</li> <li>• Explain the differences between tasks that can and cannot be accomplished with a computer.</li> <li>• Analyze the effects of computing on society within economic, social, and cultural contexts.</li> <li>• Communicate legal and ethical concerns raised by computing innovation.</li> <li>• Explain the implications of communication as data exchange.</li> </ul>
Problem Solving	Logic	algorithm problem solving process	scientific and technical innovation	The logic of the problem-solving process has contributed to	Criterion B: All strands	<ul style="list-style-type: none"> <li>• Critical Thinking</li> <li>• Research Skills</li> </ul>	Introduce data collection and problem solving

		abstraction		scientific and technological innovations.	<p>Criterion C: All strands</p> <p>Criterion D: All strands</p>		<p>Introduce the four steps of the problem solving process</p> <p>Apply the problem solving process. Use different strategies to plan and carry out the plan to solve several problems</p> <p>Reinforce the four steps of the problems solving process</p> <p>Count in the binary number system. Convert between binary and decimal numbers in the context of topics that are important to computer science</p> <p>Introduce the linear and binary search algorithms.</p> <p>Explore sorted and unsorted lists and various sorting algorithms</p> <p>Introduce minimal spanning trees and how graphs can be used to help solve problems</p> <p>Final projects and presentations</p>
Web Development	Communication	Collaboration & Perspective	Personal & Cultural Expression	Creation of personal website for timely interaction with people using appropriate communication techniques drives design decisions.	<p>Criterion C: all strands</p> <p>Criterion D: All strands</p>	<p>Self Management Skills</p> <p>Research Skills</p>	<p>Students will be able to:</p> <p>Identify the reasons someone might visit a given website</p>

							<p>Identify the reasons someone might create a given website</p> <p>Identify websites as a form of personal expression</p> <p>Explain that HTML allows a programmer to communicate the way content should be structured on a web page</p> <p>Write a simple HTML document that uses opening and closing tags to structure content</p> <p>Explain the purpose of copyright.</p> <p>Identify the rights and restrictions granted by various Creative Commons licenses</p> <p>Add an image to a web page</p> <p>Describe why using whitespace, indentation, and comments makes your code easier to maintain</p> <p>Develop a set of techniques for preventing bugs in HTML code and finding them when they occur</p>
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							<p>Connect multiple web pages into one website using hyperlinks.</p> <p>Use CSS selectors to style HTML text elements.</p> <p>Create and link to an external style sheet.</p> <p>Explain the differences between HTML and CSS in both use and syntax.</p> <p>Use CSS properties to change the size, position, and borders of elements.</p> <p>Create a CSS rule-set for the body element that impacts all elements on the page.</p> <p>Use basic web searching techniques to find relevant information online</p> <p>Identify elements that contribute to a website's trustworthiness or untrustworthiness</p> <p>Group elements using classes in order to create more specific styles on their website.</p> <p>Apply the rgb() color function to add custom colors to their website</p> <p>Apply CSS styles across an entire website</p>
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							<p>Explain the design choices they made on their website to other people</p> <p>Prioritize and implement incremental improvements</p>
Introduction to Programming	Creativity	variable program conditionals iteration and looping	Personal & Cultural Expression	The creativity of a variable program, conditionals, and iteration and looping are a part of human expression.	A, B	<ul style="list-style-type: none"> <li>• Critical Thinking</li> <li>• Communication</li> </ul>	<p>Introduce the Scratch programming language, including the basic terms utilized in the language.</p> <p>Practice using the basic features of Scratch in the context of creating a simple program.</p> <p>Create a dialogue between two sprites.</p> <p>Introduce the methods of moving sprites in Scratch.</p> <p>Practice the concept of event driven programming through the creation of an alphabet game.</p> <p>Introduce the concept of broadcasting via role play.</p> <p>Write Scratch stories and present them to the class. Peer reviews are conducted.</p> <p>Introduce the concept of variable.</p> <p>Introduce the concept of conditionals.</p> <p>Introduce And, Or and randomness.</p>

Unit title	Key concept	Related concept(s)	Global context	Statement of Inquiry	Objectives	ATL skills	Content
Energy	Change	Resources Sustainability	Globalization and Sustainability	The use of sustainable resources can lead to global growth and development.	Objective D: Evaluating i. Design detailed and relevant testing methods, which generate data, to measure the success of the solution ii. critically evaluate the success of the solution against the design specification iii. Explain how the solution could be improved iv. explain the impact of the solution on the client/target audience	Thinking: Critical thinking-analyse experimental results and report out conclusions	Energy sources Power and Energy Sources in the home  The Power Grid  Electrical Circuits  Simulation  Circuit  Calculations  Power and Energy in Series and Parallel  Circuit  Mechanical Efficiency (the Winch)  Thermodynamics  Renewable Insulation  Renewable Energy Machine Design and Test
Materials and Structures	Systems	Form, Function	Scientific and Technological Innovation	The geometric form of a system can be defined by the function of the system.	Objective A: Inquiring and analysing i. explain and justify the need for a solution to a problem for a specified client/target audience ii. identify and prioritize primary and secondary research needed to develop a solution to the problem	Self-Management: Organization-plan the creation of a solution	Energy sources Power and Energy Sources in the home  The Power Grid  Electrical Circuits Simulation  Circuit Calculations

					<ul style="list-style-type: none"> <li>iii. analyse a range of existing products that inspire a solution to the problem</li> <li>iv. develop a detailed design brief, which summarizes the analysis of relevant research.</li> </ul>		<p>Power and Energy in Series and Parallel Circuit</p> <p>Mechanical Efficiency (the Winch)</p> <p>Thermodynamics</p> <p>Renewable Insulation</p> <p>Renewable Energy</p> <p>Machine Design and Test</p>
Control Systems	Systems	Innovation, Function	Scientific and Technical Innovation	Innovation can occur when a system's functions are improved or changed.	<p>Criterion C - Creating the solution</p> <ul style="list-style-type: none"> <li>i. construct a logical plan, which describes the efficient use of time and resources, sufficient for peers to be able to follow to create the solution</li> <li>ii. demonstrate excellent technical skills when making the solution</li> <li>iii. follow the plan to create the solution, which functions as intended</li> <li>iv. fully justify changes made to the chosen design and plan when making the solution <ul style="list-style-type: none"> <li>a. present the solution as a whole</li> </ul> </li> </ul> <p>Criterion D - Evaluating</p> <ul style="list-style-type: none"> <li>i. design detailed and relevant testing methods, which generate data, to measure the success of the solution</li> <li>ii. critically evaluate the success of the solution against the design specification</li> <li>iii. explain how the solution could be improved</li> <li>iv. explain the impact of the solution on the client/target audience.</li> </ul>	Self Management: Organization -- Students develop a plan for completing design project	?

Mechanisms	Systems	Function, ergonomic	Scientific and Technological Innovation	Innovation can occur when system functions are designed to optimize ergonomics.	<p>Objective B: Developing Ideas</p> <ul style="list-style-type: none"> <li>i. Develop design specifications, which clearly states the success criteria for the design of a solution</li> <li>ii. develop a range of feasible design ideas which can be correctly interpreted by others</li> <li>iii. present the final chosen design and justify its selection</li> <li>iv. develop accurate and detailed planning drawings/diagrams and outline the requirements for the creation of the chosen solution.</li> </ul> <p>Objective C: Creating the solution</p> <ul style="list-style-type: none"> <li>i. construct a logical plan, which describes the efficient use of time and resources, sufficient for peers to be able to follow to create the solution</li> <li>ii. demonstrate excellent technical skills when making the solution</li> <li>iii. follow the plan to create the solution, which functions as intended</li> <li>iv. fully justify changes made to the chosen design and plan when making the solution</li> </ul> <p>present the solution as a whole</p>	Communication: Develop detailed design drawings	<p>How to Use Vex</p> <ul style="list-style-type: none"> <li>6 simple machines</li> <li>Simple Machine Investigation</li> <li>Simple Machines Practice Problems</li> <li>Gears</li> <li>Pulley Drives and Sprockets</li> <li>Gears, Pulley Drives and Sprockets Practice Problems</li> <li>Compound Machine</li> </ul>
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Modelling Skills	Creativity	Form Perspective Evaluation	Scientific and Technical Innovation	Students will create a product from conception to reality and will employ a variety of modeling techniques to emphasize technical innovation.		<p>Communication</p> <p>Students will develop detailed design drawings for a manufacturer and turn 2D sketches into 3D CAD models</p> <p>Thinking</p> <p>Students will plan the creation of a solution, analyse their solution and improve them</p>	<p>Standards for Technological Literacy</p> <p>AA. Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development. (2.9-12.AA)</p> <p>BB. Optimization is an ongoing process or methodology of designing or making a product and is dependent on criteria and constraints. (2.9-12.BB)</p> <p>H. The design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype. (8.9-12.H)</p> <p>J. The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved. (8.9-12.J)</p> <p>K. Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other. (8.9-12.K)</p> <p>N. Identify criteria and constraints and determine how these will affect the design process. (11.9-12.N)</p> <p>Q. Develop and produce a product or system using a design process. (11.9-12.Q)</p> <p>R. Evaluate final solutions and communicate observation, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to 3D models. (11.9-12.R)</p>
Reverse Engineering	Creativity	Form, Perspective,	Scientific and Technical Innovation	Strategic design and inquiry processes	Criteria A: i. audience iii. Criteria B:	<p>Communication</p> <p>Students will develop detailed design drawings for a manufacturer and</p>	<p>Standards for Technological Literacy</p> <p>AA. Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they</p>

		Evaluation, Ergonomics		guide the development of an effective solution to a problem through exploring, visualizing, communicating and analyzing engineering designs and technical information	i. ii. Criteria C: iii. vi. Criteria D: ii. iii.	turn 2D sketches into 3D CAD models  Thinking Students will plan the creation of a solution, analyse their solution and improve them	affect the final design and development. (2.9-12.AA) BB. Optimization is an ongoing process or methodology of designing or making a product and is dependent on criteria and constraints. (2.9-12.BB) H. The design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype. (8.9-12.H) J. The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved. (8.9-12.J) K. Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other. (8.9-12.K) N. Identify criteria and constraints and determine how these will affect the design process. (11.9-12.N) Q. Develop and produce a product or system using a design process. (11.9-12.Q) R. Evaluate final solutions and communicate observation, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to 3D models. (11.9-12.R)
Design Teams	Creativity	Form, Collaboration, Evaluation, Function	Scientific and Technological Innovation	Students will create a product from conception to reality and will exemplify project planning tools and management skills in the process of	Criteria A: ii. iv. Criteria B: iii. iv. Criteria C: i. ii. iv. Criteria D: i.	COMMUNICATION Students will develop detailed design drawings for a manufacturer and turn 2D sketches into 3D CAD models  SELF MANAGEMENT  Students will plan the creation of a solution,	Standards for Technological Literacy AA. Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development. (2.9-12.AA) BB. Optimization is an ongoing process or methodology of designing or making a product and is dependent on criteria and constraints. (2.9-12.BB) H. The design process includes defining a problem, brainstorming, researching and

				<p>solving engineering design problems.</p>	<p>iv.</p>	<p>analyse their solution and improve them</p>	<p>generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype. (8.9-12.H)</p> <p>J. The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved. (8.9-12.J)</p> <p>K. Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other. (8.9-12.K)</p> <p>N. Identify criteria and constraints and determine how these will affect the design process. (11.9-12.N)</p> <p>Q. Develop and produce a product or system using a design process. (11.9-12.Q)</p> <p>R. Evaluate final solutions and communicate observation, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to 3D models. (11.9-12.R)</p>
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