**Area of Learning: Applied Design, Skills, and Technologies — Engineering Grade 12**

**BIG IDEAS**

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| **Design for the life cycle** includes consideration  of social and  **environmental impacts**. |  | Personal design  interests require  the evaluation and refinement of skills. |  | Tools and **technologies** can  be adapted for  specific purposes. |

**Learning Standards**

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| **Curricular Competencies** | **Content** |
| *Students are expected to be able to do the following:*  Applied Design  Understanding context   * Engage in a period of **user-centred research** and **empathetic observation**  to understand design opportunities   Defining   * Establish a point of view for a chosen design opportunity * Identify potential users, intended impacts, and possible unintended negative consequences * Make decisions about premises and **constraints** that define the design space,  and identify criteria for success * Determine whether activity is collaborative or self-directed   Ideating   * Identify and examine gaps for potential design improvements and innovations * Critically analyze how competing social, ethical, and sustainability considerations impact creation and development of solutions * Generate ideas to create a range of possibilities and add to others’ ideas in ways  that create additional possibilities * Evaluate suitability of possibilities according to success criteria, constraints,  and potential gaps, and prioritize for prototyping * Work with users throughout the design process | *Students are expected to know the following:*   * design for the life cycle * **mathematics** in advanced engineering projects * **measurement techniques** in advanced engineering projects * advanced static analysis of structures:   + stress-strain analysis   + stress analysis software * **non-destructive testing** anddestructive testing * materials science:   + metals and alloys (metallurgy)   + ceramics   + plastics and polymers   + composites * **geometric dimensioning and tolerancing** * vibrations and **seismic analysis** * programming languages and applications * quality control methods * **physics** in advanced engineering projects * robotics and robotic manufacturing |

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**Learning Standards (continued)**

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| **Curricular Competencies** | **Content** |
| Prototyping   * Choose an appropriate form, scale, and level of detail for prototyping, and  plan procedures * Analyze the design for the life cycle and evaluate its **impacts** * Visualize and construct prototypes, making changes to tools, materials,  and procedures as needed * Record **iterations** of prototyping   Testing   * Identify and communicate with **sources of feedback** * Develop an **appropriate test** of the prototype, conduct the test, and collect  and compile data * Evaluate design according to critiques, testing results, and success criteria  to make changes   Making   * Identify appropriate tools, technologies, materials, processes, cost implications,  and time needed * Create design, incorporating feedback from self, others, and results from testing  of the prototype * Use materials in ways that minimize waste   Sharing   * Decide how and with whom to **share** creativity, or share and promote design  and processes * Share the product with users and critically evaluate its success * Critically reflect on plans, products and processes, and identify new design goals * Evaluate new possibilities for plans, products and processes, including how they  or others might build on them   Applied Skills   * Apply safety procedures for themselves, co-workers, and users in both physical  and digital environments | * future career options and opportunities  in engineering, including design, production,  and emerging applications * **interpersonal and consultation skills**  for interacting with colleagues and clients |

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**Learning Standards (continued)**

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| **Curricular Competencies** | **Content** |
| * Individually or collaboratively identify and assess skills needed for design interests * Demonstrate competency and proficiency in skills at various levels involving  manual dexterity * Develop specific plans to learn or refine identified skills over time   Applied Technologies   * Explore existing, new, and emerging tools, technologies, and systems to evaluate suitability for design interests * Evaluate impacts, including unintended negative consequences, of choices made  about technology use * Analyze the role that changing technologies play in multiple engineering contexts |  |