**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 DesignUnderstanding 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
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