

BIG IDEAS

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

Curricular Competencies	Content
<p><i>Students are expected to be able to do the following:</i></p> <p>Applied Design</p> <p><i>Understanding context</i></p> <ul style="list-style-type: none"> Engage in a period of user-centred research and empathetic observation to understand design opportunities <p><i>Defining</i></p> <ul style="list-style-type: none"> 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 <p><i>Ideating</i></p> <ul style="list-style-type: none"> 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 	<p><i>Students are expected to know the following:</i></p> <ul style="list-style-type: none"> design for the life cycle mathematics in advanced engineering projects measurement techniques in advanced engineering projects advanced static analysis of structures: <ul style="list-style-type: none"> stress-strain analysis stress analysis software non-destructive testing and destructive testing materials science: <ul style="list-style-type: none"> 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

Learning Standards (continued)

Curricular Competencies	Content
<p>Prototyping</p> <ul style="list-style-type: none"> 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 <p>Testing</p> <ul style="list-style-type: none"> 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 <p>Making</p> <ul style="list-style-type: none"> 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 <p>Sharing</p> <ul style="list-style-type: none"> 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 <p>Applied Skills</p> <ul style="list-style-type: none"> Apply safety procedures for themselves, co-workers, and users in both physical and digital environments 	<ul style="list-style-type: none"> future career options and opportunities in engineering, including design, production, and emerging applications interpersonal and consultation skills for interacting with colleagues and clients

Learning Standards (continued)

Curricular Competencies	Content
<ul style="list-style-type: none"> • 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 <p>Applied Technologies</p> <ul style="list-style-type: none"> • 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 	