



CONTEST DESCRIPTION

# Mechanical Engineering

TEAM CANADA

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## 1 THE SKILLS FOR SUCCESS FOR CAREER IN THE SKILLED TRADES AND TECHNOLOGY

In response to the evolving labour market and changing skill needs, the Government of Canada has launched the new Skills for Success (former Essential Skills) model defining nine key skills needed by Canadians to participate in work, in education and training, and in modern society more broadly. SCC is currently working with Employment and Social Development Canada (ESDC) to bring awareness of the importance of these skills that are absolutely crucial for success in Trade and Technology careers. Part of this ongoing initiative requires the integration and identification of the Skills for Success in contest descriptions, projects, and project documents. The next phase and very important aspect of our Skills for Success (SfS) initiative is to provide a Skills Report Card to each competitor at the Skills Canada National Competition. The purpose of the report card is to inform the competitor about their current level of nine identified Skills for Success based on their competition scores. With this knowledge, the competitor will be made aware which skill may require improvement. Full implementation is expected in the next Skills Canada National Competition.

The following 9 skills have been identified and validated as key skills for success for the workplace in the legend below:

<sup>1</sup>Numeracy, <sup>2</sup>Communication, <sup>3</sup>Collaboration, <sup>4</sup>Adaptability, <sup>5</sup>Readingt, <sup>6</sup>Writing, <sup>7</sup>Pro blem Solving, <sup>8</sup>Creativity and Innovation, <sup>9</sup>Digital

These Skills for Success have been identified in section 2.4 and/or 3.2 of your Contest Description and if applicable, in your Project and supporting documents.

## 2 CONTEST INTRODUCTION

### 2.1 Description of the associated work role(s) or occupation(s)

[https://www.skillscompetencescanada.com/en/skill\\_area/mechanical-cadd/](https://www.skillscompetencescanada.com/en/skill_area/mechanical-cadd/)

### 2.2 Purpose of the Challenge

To evaluate each contestant's preparation for employment in the field of Engineering Design and Drafting using CAD and to recognize outstanding students for excellence & professionalism in their field.

### 2.3 Duration of contest

10 – 12 hours across two days

### 2.4 Skills and Knowledge to be tested.

## Work organization and management

The competitor needs to know and understand:

- The various purposes and uses for CAD designs
- Current internationally recognized standards (ISO)
- Standards currently used and recognized by industry
- Health and safety legislation and best practice including specific safety precautions when using a visual display unit (VDU) and in a workstation environment
- Relevant theory and applications of mathematics, physics, and geometry
- Technical terminology and symbols
- Recognized IT systems and related professional design software
- The importance of accurate and clear presentation of designs to potential users
- The importance of effective communications and inter-personal skills between co-workers, clients and other related professionals
- The importance of maintaining knowledge and skill in new and developing technologies
- The role of providing innovative and creative solutions to technical and design problems and challenges

The individual shall be able to:

- Apply consistently the internationally recognized standards (ISO) and standards currently used and recognized by industry
- Apply and promote health and safety legislation and best practice in the workplace
- Apply a thorough knowledge and understanding of mathematics, physics and geometry to CAD projects
- Access and recognize standard component and symbol libraries
- Use and interpret technical terminology and symbols used in preparing and presenting CAD drawings
- Use recognized IT systems and related professional design software to consistently produce high quality designs and interpretations
- Deal with systems problems such as error messages received, peripherals which do not respond as expected, and faults with equipment or connecting leads
- Produce work that consistently meets high standards of accuracy and clarity in the design and presentation of designs to potential users
- Effectively communicate and use interpersonal skills with co-workers, clients, and other related professionals to ensure that the CAD process meets requirements

- Describe to clients and other professionals the role and purposes for CAD designs
- Explain complex technical images to experts and non-experts, highlighting key elements
- Maintain proactive continuous professional development in order to maintain current knowledge and skill in new and developing technologies and practices
- Provide and apply innovative and creative solutions to technical and design problems and challenges
- Visualize desired products in order to fulfil clients' briefs accurately

### **Materials, software, and hardware**

The individual needs to know and understand:

- Computer operating systems to be able to use and manage computer files and software correctly
- Peripheral devices used in the CAD process
- Specific specialist technical operations within design software
- The range, types and uses of specialist product available to support and facilitate the CAD process
- The production process for designs
- The limitations of design software
- Formats and resolutions
- The use of plotters, printers, and FDM 3D printers

The individual shall be able to:

- Power up the equipment and activate the appropriate modelling software
- Set up and check peripheral devices such as keyboard, mouse, 3D mouse, plotter, and printer
- Use computer operating systems and specialist software to create and manage and store files proficiently
- Select correct drawing packages from an on-screen menu or graphical equivalent
- Use various techniques for accessing and using CAD software such as a mouse, menu, or tool bar
- Configure the parameters of the software
- Plan production processes effectively to produce efficient work processes
- Use plotters and printers to print and plot work

### **3D Modelling Skills**

The individual needs to know and understand:

- Computer operating systems in order to use and manage computer files and software
- Mechanical systems and their functionality
- Principles of technical drawing
- How a component is assembled

The individual shall be able to:

- Model components, optimizing the constructive solid geometry
- Create families of components
- Assign characteristics to the materials (density)
- Assign colours and textures to the components
- Produce assemblies from 3D models of components
- Structure assemblies (sub-assemblies)
- Review base information to plan work effectively
- Access information from data files
- Model and assemble base components of project pieces
- Estimate approximate values for any missing dimensions
- Assemble modelled parts into sub-assemblies as required
- Apply graphics decals such as logos as required onto images
- Save work for future access

### **Create photo rendered images (2D) and creation of animations**

The individual needs to know and understand:

- The use of lighting, scenes and decals to produce photo rendered images

The individual shall be able to:

- Save and label images to access for further use
- Interpret source information and accurately apply to the computer-generated images
- Apply material properties using information supplied from source drawings
- Create photo rendered images of components or assemblies
- Adjust colours, shading, backgrounds and camera angles to highlight key images
- Use camera settings to show better angles of the project
- Print completed images for presentation purposes
- Create functions relative to the operation of the system being designed, using industry programmes
- Create animations that demonstrate how different parts work are assembled

### **Reverse engineering of physical models**



The individual needs to know and understand:

- Materials and processes for obtaining unprocessed work pieces:
- Castings
- Welding
- Machining
- Simulation
- The process to transfer real objects to 3D images/3D models and then to technical drawings

The individual shall be able to:

- Determine dimensions on physical parts by using industry accepted instruments
- Create freehand sketches
- Use measuring instruments to produce accurate replicas

### **Technical drawing and measuring**

The individual needs to know and understand:

- Working drawings in ISO standard together with any written instructions
- Standards for conventional dimensioning and tolerancing and geometric dimensioning and tolerancing appropriate to the ISO standard
- Rules of technical drawing and the prevailing latest ISO standard to govern these rules
- The use of manuals, tables, list of standards, and product catalogues

The individual shall be able to:

- Generate working drawings in ISO standard together with any written instructions
- Apply standards for conventional dimensioning and tolerancing and geometric dimensioning and tolerancing appropriate to the ISO standard
- Apply the rules of technical drawing and the prevailing latest ISO standard to govern these rules
- Use manuals, tables, lists of standards, and product catalogues
- Insert written information such as explanation balloons and parts lists with more than one column using annotation styles that meet ISO standards
- Create 2D detail technical drawings
- Create exploded isometric views

## **3 CONTEST DESCRIPTION**

### 3.1 List of documents produced and timeline for when competitors have access to the documents on the Skills/Compétences Canada website

All competition documents will be distributed and posted as they become available during the competition.

DOCUMENT	DATE OF DISTRIBUTION
Project	During the competition

### 3.2 Tasks that may be performed during the contest

- Sketching, analyzing measurements and part measuring<sup>1</sup>
- Implement design changes by using problem solving, decision making and critical thinking skill<sup>7</sup>
- Detail Drawing from assembly and blueprint document interpretation<sup>5, 6</sup>
- Assembly from details
- Parametric Modeling – Family of parts and/or assemblies
- Rendering<sup>9</sup>
- Animation<sup>8</sup>
- Export .STL files with proper units and resolution for additive manufacturing
- Rapid prototyping (3D Printing)
- Exporting drawings as 2D and 3D PDF files<sup>9</sup>
- Import and export a STP (STEP) file(s)<sup>9</sup>
- Weldments
- Sheetmetal
- Surface Modeling<sup>9</sup>

*Skills for Success – <sup>1</sup>Numeracy, <sup>5</sup>Reading, <sup>6</sup>Writing, <sup>7</sup>Problem Solving, <sup>8</sup>Creativity & Innovation, <sup>9</sup>Digital*

## 4 EQUIPMENT, MATERIAL, CLOTHING

### 4.1 Equipment and material provided by Skills/Compétences Canada

- 3D Printers if applicable

**COMPETITORS WILL BE REQUIRED TO USE THE MATERIAL AND EQUIPMENT PROVIDED BY SCC. ALL OTHER MATERIAL AND EQUIPMENT WILL BE REMOVED FROM THE SKILL AREA.**



## 4.2 Equipment and material provided by the competitor

- Competitors must bring their own computer, monitor (two recommended, three max), and peripherals (3d navigator allowed).
- Contestant must have administrative rights to the computer and are responsible for the functioning of their own equipment.
- A legally licensed 3D parametric CAD modeling and surfacing software (including the applicable help files) must be installed on the competitor's computer and brought to the competition.
- Competitors must ensure a legally obtained version of Microsoft Excel is installed on their computer
- If competitors are bringing a computer or laptop from their school (instead of their personal computer), please ensure that the computer is unlocked so documents and possibly software can be saved/installed to the hard drive and technology support can be provided onsite. This may require access to CMOS settings.
- Calculator
- Any reference materials (no photocopies, materials may be PDF documents or published books, journals, etc.)
- Pencils, Sketching Paper

### 4.2.1 Toolboxes Guidelines

One of the objectives of SCC is the sustainability of the Competition. As a result, the toolboxes brought by Competitors will be restricted to the following maximum specifications.

The Competitor toolbox must not exceed 0.5 meters<sup>3</sup> in volume. It can be multiple toolboxes but the total of all toolboxes must not exceed the maximum volume indicated. There is no exception to this rule. If the Competitor toolbox is larger than what is indicated, the Competitor with the guidance of the Expert, will need to remove items from the toolbox and those items will not be used during the competition. All tools must fit inside one or more toolboxes. Tools outside of a toolbox will not be permitted.

## 4.3 Required clothing provided by the competitor

- N/A

## 5 HEALTH AND SAFETY

### 5.1 Safety program

SCC has implemented a comprehensive safety program as health and safety is an integral part of our competitions. Our safety program includes guidelines and procedures to make the work environment in each skill area safer.

#### 5.1.1 Safety manual

As part of our program a safety manual has been created in order to monitor and document health and safety within each skill area. It includes a definite plan of action designed to prevent accidents. The safety manual will be provided for every skill and these instructions must be followed and respected by all participants and officials at the SCNC.

#### 5.1.2 Safety workshop

During orientation, Competitors will participate in a Safety workshop and they will be expected to work and maintain a safe working area during the competition. Any Competitor breaking any health, safety, and environmental rules, may be required to undertake a second safety workshop, this will not affect the Competitor's competition time.

### 5.2 List of required personal protective equipment (PPE) provided by competitors

- N/A

### 5.3 COVID-19 Protocol

The COVID-19 guidelines will be shared as soon as they are available.

The COVID-19 guidelines will be subject to change based on the BC COVID-19 guidelines in place at the time of the competition.

## 6 SAFETY REQUIREMENTS

### 6.1 Safety workshop

Upon arrival at the Skill area, Competitors will participate in a Safety workshop and they will be expected to work and maintain a safe working area during the competition. Any Competitor breaking any health, safety and environmental rules, may be required to undertake a second safety workshop, this will not affect the Competitor's competition time.

### 6.2 List of required personal protective equipment (PPE) provided by Skills/Compétences Canada

- N/A

### 6.3 List of required personal protective equipment (PPE) provided by the competitor

- N/A

**Note:** Contestants who do not have the required protective gear will not be allowed to participate in the contest

## 7 ASSESSMENT

### 7.1 Point breakdown

**Note:** This list is subject to change.

TASKS	/100
Assembly and Detail Modeling	25
Part Design	25
Reverse Engineering	25
Design Change and Parametric Modeling	25

## 8 CONTEST SPECIFIC RULES

Contest specific rules cannot contradict or take priority over the Competition Rules. They do provide specific details and clarity in areas that may vary from contest to contest. Any additional contest rules will be reviewed during the competitor orientation.

TOPIC/TASK	CONTEST SPECIFIC RULE
Use of technology - personal laptops, tablets and mobile phones	<ul style="list-style-type: none"> <li>• Use is permitted but within limits to be specified during the competition</li> </ul>
Drawings, recording information	<ul style="list-style-type: none"> <li>• Recording is not permitted</li> </ul>
Tools / Infrastructure	<ul style="list-style-type: none"> <li>• Tools supplied by competitors are their responsibility to secure and maintain</li> </ul>

## 9 ADDITIONAL INFORMATION

### 9.1 Interpreter

If a competitor requires the help of an interpreter once onsite during the competition, the Skills/Compétences Canada Provincial/Territorial offices must advise Skills/Compétences Canada National Secretariat a minimum of 1 month prior to the competition or this service might not be guaranteed.

## 9.2 Ties

- Tiebreaker #1: The competitor with the highest score in the Reverse Engineering task will be declared the winner
- Tiebreaker #2: The competitor with the highest mark in the Assembly & Detail Modelling will be declared the winner.
- Tiebreaker #3: The competitor with the highest mark in Design Change & Parametric Modelling will be declared the winner

## 9.3 Test Project change at the Competition

Where the Test Project has been circulated to Competitors in advance, Expert shall change a maximum of 30% of the work content. Please refer to the Competition Rules.

## 9.4 Competition rules

Refer to the competition rules of the Skills Canada National Competition which can be found on our website.

## 10 TEAM CANADA EXPERT

Jeremy Braithwaite
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Contact the Skills/Compétences Canada national secretariat for any questions or concerns: Sophie Courchene at [sophie@skillscanada.com](mailto:sophie@skillscanada.com)