

JANUARY 23rd-24th
2021



ONTARIO ENGINEERING COMPETITION

Pre-Delegate Package



/OEC2021



/42ndOEC



/company/oec2021

www.oec2021.ca

SCHEDULE

SATURDAY

10:00 - 10:30 am

Welcome Ceremony

10:30 - 11:30 am

Competition Briefing

11:30 am - 7:30 pm

Competitions + Presentations

7:30 - 8:30 pm

Dinner break

8:30 - 11:00 pm

Night Social Event

SUNDAY

8:00 am - 4:00 pm

Competition Presentations

12:30 - 4:30 pm

Networking Events

4:00 - 5:00 pm

Break

8:00 - 10:00 pm

Awards Gala and Closing Ceremonies

7:00 - 8:00 pm

Dinner break

10:00pm - 12:00 am

Final Night Social Event

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*All events are to be conducted through online platforms.

THINGS TO KNOW

Date: January 23-24. 2021

Location:

Online - information for accessing the online platforms to be given in delegate package

Fees:

Delegate/Competitor: \$50

Observer: Free

Important:

Only first place teams will be able to attend OEC 2021. There cannot be two teams from the same school competing in the same competition - unless you have a Semester A and Semester B team. Please read the attached OEC Rulebook which has been updated from last year. Also attached is the Canadian Engineering Competition (CEC) Rulebook.

Platforms to be used:

Zoom, Hopin, Discord and YouTube

You will be notified to sign up/register on certain platforms prior to the competition

COMPETITIONS



CONSULTING

The purpose of the Consulting engineering competition is to challenge competitors to design a detailed solution to a large-scale engineering problem. The proposal must be made in a way that promotes the solution to the client, similar to the role of an engineering consultant.

There is a maximum of 4 members per team. Day 1 of the competition gives competitors a 4-8 hour work period. Expected submission deliverables include a 10 page limit report and presentation slides. Day 2 teams will have a dedicated closed-door presentation period to present their designs to a panel of judges



COMMUNICATIONS

The goal of this competition is to describe an engineering topic in terms that the general public can understand. Competitors are to exhibit their mastery of communication skills that are necessary in the field of engineering that works with teams of people in both technical and non-technical backgrounds.

There is a maximum of 2 members per team. One week prior to the competition, competing teams will be expected to submit an abstract and presentation slides. Day 1 competing teams will have a dedicated presentation period to present to the judges and a public virtual audience.



INNOVATIVE DESIGN

The innovative design competition is prepared entirely outside the realm of the OEC. Competitors choose their own topic, prepare research and develop a design. The designs must be new and innovative and address a void in society.

There is a maximum of 6 members per team. Prior to the competition, competing teams will be expected to submit a one page design summary. Teams may also be requested to submit a virtual tri-fold board, presentation slides, and/or pre-recorded presentation video at this time as well. Day 1 the competitors will have a scheduled Q&A judging period with a panel of judges.

COMPETITIONS



JUNIOR DESIGN

This competition challenges junior engineering students to design and build a prototype to address a technical problem.

There is a maximum of 4 members per team. Day 1 of the competition gives competitors a 4-6 hour work period. Expected submission deliverables may include the following: videos/photos of the prototype, requested simulation/CAD files, and presentation slides. Day 2 competing teams will have a dedicated closed-door presentation period to present their designs to a panel of judges.



SENIOR DESIGN

Students are given a complex engineering problem and are required to design and build a working prototype. The teams will then present their solution and test their prototypes in front of a panel of judges.

There is a maximum of 4 members per team. Day 1 of the competition gives competitors a 8-10 hour work period. Expected submission deliverables may include the following: videos/photos of the prototype, requested code files, requested simulation/CAD files, and presentation slides. Day 2 competing teams will have a dedicated closed-door presentation period to present their designs to a panel of judges.



PARLIAMENTARY DEBATES

Parliamentary Debate Competitors must use analytical techniques to present, with minimum preparation, a reasoned point of view of a resolution that has not been disclosed beforehand. The goal is to assess the competitors' abilities to convey ideas and develop arguments.

There are exactly 2 members per team. The format will be similar to previous years as a double elimination bracket. Some rules have been modified for the online format (e.g. no heckling) and is reflected in the OEC 2021 Rulebook. Each debate round will be conducted in front of a panel of judges.

COMPETITIONS



PROGRAMMING

The goal of the programming category is to encourage engineering students to produce a piece of readable software to fulfill the given requirements and under limited time. Competitors are expected to design, test, develop and present a quality software product with its documentation.

There is a maximum of 4 members per team. Day 1 of the competition gives competitors a 6-8 hour work period. Expected submission deliverables will include the final software and presentation slides. Day 2 competing teams will have a dedicated closed-door presentation period to present their designs to a panel of judges.



RE-ENGINEERING

In this competition, students will be required to apply the re-engineering process to an existing product or system in order to add new functionality to it or enhance its original functionality. The intent of these improvements will be to re-process the product or system according to the original or requested objective.

There is a maximum of 2 members per team. Competitors will have 2 cases to work on. The first case will be released a week prior to the competitors and the competing team has the full week to work on this case. Case 2 will be released on day 1 of the competition weekend and competitors will have a 4-8 hours work period. The reports for both cases 1 and 2 are due at the end of this work period along with the presentation slides. Day 2 competing teams will have a dedicated closed-door presentation period to present their designs to a panel of judges.

NECESSARY SKILLS



Consulting

Using the following list of hard skills, competitors will be required to create an engineering design development project based on the following assessment criteria: profitability, constraints, criteria, societal impact, environmental life cycle and overall effectiveness. The competitors will be required to support their design through technical documentation. The design process and relevant hard skills can be broken down as follows:

- *Design a suitable solution to the given constraints*
 - *Understanding of engineering design criteria and constraints*
 - *Use of project timelines*
 - *Use of design matrices to assess design feasibility*
 - *General engineering problem solving abilities*
- *Project an economic/capital analysis of the presented solution*
 - *Understanding of engineering economics*
 - *Involves a long term project assessment and cash flow with continued operating and -maintenance costs, initial startup costs, and revenue*
 - *Implementation of a well educated hypothesis regarding market trends and research*
- *Project societal impact of the presented solution*
 - *Consideration of engineering laws and ethics*
- *Project and break down the environmental life cycle of the presented solution*
 - *Consideration of environmental governing laws and hazards*

NECESSARY SKILLS



Communications

Using the following list of hard skills, competitors will be expected to exhibit a proficiency in the following: communication skills, problem analysis, passion for engineering topics, and application of engineering knowledge towards global issues. Each team will be required to explain and defend a technical engineering topic to a panel of judges with varying educational backgrounds and professions (both technical and non-technical). The design process and relevant hard skills can be broken down follows:

- *Select a technical issue with global significance*
 - Explain why it is an important topic to discuss*
- *Integrating engineering knowledge into argument*
 - Use fundamental engineering concepts to further discuss the issue and what are the effects*
 - Can pull knowledge from compulsory topics (excluding engineering) into arguments (social, economic, political, environmental)*
- *Demonstrate professional presentation skills*
 - Uses a clear, engaging tone, allow pauses (integrated into presentation) for the audience, illustrating key points*
 - There is a clear introduction and conclusion*
 - Selects appropriate language for an audience of different educational backgrounds and areas of expertise (both technical and non-technical)*
- *Knowledge of the topic*
 - Can answer questions prompted from the judges panel and/or public audience*
- *Professionalism*
 - Dressed professionally*
 - On time*
 - Confident*
 - Organized*

NECESSARY SKILLS



Innovative Design

Using the following list of hard skills, competitors are expected to solve an open-ended engineering problem and present a real world solution that is a marketable and feasible design. Given the open-ended nature of the competition, competitors require the ability to self-define reasonable design constraints and criteria. The relevant hard skills can be broken down as follows:

- *Defining a problem with modest complexity*
 - Defining appropriate constraints and criteria to assess the design and narrow the scope or objective*
- *Ability to synthesize feasible solutions using engineering tools such as critical path analysis, decision matrix and sensitivity analysis*
- *Model simulation and/or prototyping skills*
- *Written communication skills*
- *Professional presentation skills marketing the design and its construction*
- *Economic feasibility - perhaps through an economic analysis*
- *Environmental and societal implications*
 - Using engineering project tools such as life-cycle assessment*
 - Knowledge of engineering ethics and impact*

NECESSARY SKILLS



Junior Design

Using the following list of hard skills, competitors will be required to create an engineering design development project with a simulated and/or physical prototype. The competitors must consider the design's profitability, constraints, criteria, societal impact, environmental impact, and overall effectiveness. Each team will be required to support their working prototype design through a design defense. The design process and relevant hard skills can be broken down as follows:

- *Physical and/or simulated prototype build*
 - CAD Modelling (e.g. SolidWorks)
 - Electrical schematic design (e.g. AutoCAD, Fritzing, etc.)
 - Understanding of engineering mechanics (and using parameters from CAD model)
 - Use of only the allocated time and materials
- *Design defense*
 - Economic analysis
 - Societal impact
 - Feasibility, marketability and profitability
 - Satisfaction of constraints and criteria
 - Use of parameters from CAD model or other simulations
 - Professionalism in presentation (e.g. formal attire)
 - Ability to answer questions from the judging panel with reference to the presented design

Due to the changes in this shift to an online platform, the organizing committee requests that competitors do not converge and instead work remotely for the Junior Design challenge. The competition will be structured in a way to allow for remote collaboration.

NECESSARY SKILLS



Senior Design

Using the following list of hard skills, competitors will be required to create an engineering design development project with a simulated and/or physical prototype. The competitors must consider the design's profitability, constraints, criteria, societal impact, environmental impact, and overall effectiveness. Each team will be required to support their working prototype design through a design defense. The design process and relevant hard skills can be broken down as follows:

- *Physical and/or simulated prototype build*
 - CAD Modelling (e.g. SolidWorks)
 - Electrical schematic design (e.g. AutoCAD, Fritzing, etc.)
 - Understanding of engineering mechanics (and using parameters from CAD model)
 - Technical documentation (e.g. datasheets of sensors and actuators)
- *Design defense*
 - Economic analysis
 - Societal impact
 - Feasibility, marketability and profitability
 - Satisfaction of constraints and criteria
 - Software design and development
 - Safe and knowledgeable use of electronic components
 - Understanding of an interdisciplinary system design
 - Design iteration, troubleshooting and debugging
 - Use of only the allocated time and materials
 - Use of parameters from CAD model or other simulations
 - Professionalism in presentation (e.g. formal attire)
 - Ability to answer questions from the judging panel with reference to the presented design

Due to the changes in this shift to an online platform, the organizing committee requests that competitors do not converge and instead work remotely for the Senior Design challenge. The competition will be structured in a way to allow for remote collaboration. However, to have better success with the design challenge, competitors are given the following recommendations:

- One (1) member of the team who is the designated build member. This member will be shipped parts for the competition and is recommended to have a high aptitude in mechanical prototype design and construction. This member is also recommended to have some basic knowledge of electronics or at least able to be guided remotely by another member.
- One (1) to Two (2) members of the team who are experienced with Arduino code, general algorithm development, and working with sensor datasheets.
- One (1) member who is familiar with CAD or simulated design.

**Note that this is just the recommendation by the organizing committee. Responsibility for managing the roles of the team is ultimately up to the competing team members themselves.*

NECESSARY SKILLS



Parliamentary Debates

Using the following list of hard skills, competitors will be required to present a reasoned point of view of a debate topic that has not been disclosed beforehand and without researching the topic once presented. Each team must be able to formulate arguments and convey the ideas convincingly to the audience. The relevant hard skills can be broken down as follows:

- *Adhering to the debate competition rules (note: heckling is not permitted due to the online format)*
- *Rational and convincing defense of a topic, whether on the government or opposition side*
- *Effective communication avoiding resolutions with truisms (e.g. "all", "everyone", and "always") as exceptions are always present*
- *The ability to formulate and convey arguments in a very short time span on a variety of topics*
- *Professionalism in both presentation of the topic and conduct adhering to the spirit of the competition*

NECESSARY SKILLS



Programming

Using the following list of hard skills, competitors will be required to produce a quality software. Each team is expected to design, develop, test and document the solution and present it to the panel of judges as a feasible solution to the posed problem. The design process and relevant hard skills can be broken down as follows:

- *Research and design an innovative solution to a defined engineering problem*
- *Use of any of the allowed programming languages (e.g. Python, C, Java)*
- *Limiting to only the permitted use of open-source code and referenced in the solution*
- *Develop test cases to test the solution thoroughly*
- *Provide valid documentation of the developed software (e.g. readme file)*
- *Work within the specified time and constraints*
- *Professional defense and demonstration of the solution to the judging panel*

NECESSARY SKILLS



Re-engineering

Using the following list of hard skills, competitors will be required to come up with an innovative, creative yet feasible solution to the two presented re-engineering cases. Each team will be expected to process the problem statements, constraints, criteria, solve the cases and present the solution considering economic impact, societal impact, and implementation. The solution will be presented to the panel of judges and competitors are expected to defend the engineering choices made during the process. The design process and relevant hard skills can be broken down as follows:

- *Designing a solution to a defined engineering problem*
- *Engineering report and proposal writing*
- *Interpretation of CAD (e.g. AutoCAD) diagrams*
- *Use of CAD software for drawing diagrams*
- *Engineering economic analysis considering feasibility of the design*
- *Public health and safety with knowledge of engineering laws and ethics*
- *Innovative and creative thinking*
- *Satisfying constraints and effective use of time, budget, page limit, etc.*
- *Professional presentation skills*
- *Research and reference to real world scalable solutions*
- *Demonstrate an ability to acknowledge limitations to presented design*