



ONTARIO ENGINEERING COMPETITION 2015

Junior Design

Rulebook

Zaid Al-Hashemi & Muffaz Ahmed
Junior Competition Commissioners
Jr.design@oec2015.ca

Junior Team Design

1	Category Description & Objective.....	1
2	Category Logistics	1
2.1	Awards	1
2.2	Eligibility	1
2.3	Facilities Provided by the Organizing Committee.....	2
2.4	Optional Materials Provided by the Committee	2
2.5	Facilities Provided by the Competitors.....	2
2.6	Competition Personnel.....	2
2.7	Notes on Materials	2
3	Topic Selection	2
4	Competitor Deliverables	3
5	Judging.....	3
6	Scoring	3
7	Competition Procedures.....	4
7.1	Releasing the Statement of Theme	4
7.2	Judges' Briefing.....	4
7.3	Phase 1: Releasing the Problem Statement.....	4
7.4	Phase 2: Question Period	4
7.5	Phase 3: Development of the Solution and Preparation of Deliverables	5
7.6	Phase 4: Final Presentations.....	5
7.7	Multi-Stream Judging – Determination of Final Winners	6

1 Category Description & Objective

The goal of the Junior Team Design category is to encourage junior undergraduate engineering students to produce a feasible design despite limited materials and preparation time. Engineers are often required to think quickly to produce a working solution given limited resources. In this category, competitors combine teamwork and problem solving skills to design, construct, test, and present a previously undisclosed project.

2 Category Logistics

2.1 Awards

First Place: \$1500

Second Place: \$1000

Third Place: \$500

2.2 Eligibility

- Up to sixteen (16) teams of four (4) individuals are allowed to compete in the Junior Team Design. Multidisciplinary teams are recommended, but not mandatory.
- All teams must meet all general entry requirements of OEC.
- Competitors must currently be in their first (1st) or second (2nd) academic year of engineering studies.

2.3 Facilities Provided by the Organizing Committee

- One (1) workspace per team with adequate facilities for design team meetings
- A large presentation room/area
- A “store” room for distribution of materials and tools
- One (1) lockable holding room for finished prototypes (may be combined with the store room provided there is an area for putting the prototypes that is not visible to other competitors during the competition)
- Materials, tools and safety equipment for assembly of the prototype (where necessary)
- Stop watch
- Scoring sheets
- Feedback forms

2.4 Optional Materials Provided by the Committee

- Internet access
- List of competitor-provided materials – such materials must be inexpensive and available provincially. However, the committee is encouraged to provide all materials whenever possible.
- A supervised tool room and the appropriate safety equipment (required if power tools are being used)

2.5 Facilities Provided by the Competitors

- Student owned computer(s) or laptop(s) with legal copies of software and current anti-virus protection are permitted but not required
- Materials as noted on the list from the OEC Organizing Committee (if applicable)

2.6 Competition Personnel

- One (1) Category Official
- One (1) timekeeper for the question period and solution development phases
- One (1) or more timekeeper(s) for the final presentation stage. Multiple timekeepers are needed only if there are multiple streams of judging.
- One (1) Head Judge
- Associate judges to complete the panel(s), with either three (3) or preferably five (5) judges in total on each panel
- Volunteers to carry out various support tasks

2.7 Notes on Materials

It is at the discretion of the OEC Organizing Committee as to whether all teams are provided with the same bill of materials, or whether an “open market” store is set up and each team is given the same number of credits to “buy” materials from the store.

3 Topic Selection

In Junior Team Design, the topic must be difficult enough to challenge junior engineering students, while being reasonable to produce a physical prototype within the allotted time. Use of general engineering principles should be needed for the design, but competitors should not be

expected to use senior course level knowledge. A good topic will give teams the opportunity to use novel ideas and allows for multiple design possibilities.

Topics must be fully documented in writing. All necessary documentation must be provided to competitors and judges when the problem is presented. All restrictions/constraints will also be noted.

4 Competitor Deliverables

Teams in Junior Team Design are required to design, construct, and test their project during the limited time provided in the first half of the competition and then present an oral presentation and demonstrate their design in the second half of the competition.

The oral presentation should summarize the design process, the design itself, and any unique aspects of the design to the judges and the general public. During the oral presentation, the team must demonstrate the design to show how well it meets the requirements of the project.

5 Judging

The most important aspects of evaluation in this category are the design and performance, teamwork, and the quality of the presentation.

The organizing committee should select judges that have appropriate experience in a range of disciplines. An odd number of judges must be used, preferably five (5), although three (3) is a minimum in any given panel. Multiple panels of judges may be used when required.

Judges deliberation will be conducted privately and the results will not be released until the final banquet. A feedback form from the judges will be compiled for each team and delivered to the teams individually.

6 Scoring

Design & Performance /40

Does the design work?

How well does the design meet the requirements of the project?

Note: The Design and Performance score of 40 percent may be broken down further as appropriate for the actual project. The breakdown of the Design and Performance marks will be revealed at the time that the project is revealed and is under the discretion of the Organizing committee and the judges.

Penalties

Misuse of time – late handing in prototype (To be defined as any time that the teams use such that it affects the judges or causes a delay in schedule that is not due to the fault of the OECOC and is of the fault and actions of the competing team)

-5/minute, up to -40

Team Work /25

Did the members of the team appear to work well as a team?

Did all members contribute to the problem solving process?

Presentation /20

Were the benefits and principles of the design clearly explained? (How is the design utilizing general engineering principles, minimal use of materials, and maximum efficiency of the design as determined by the challenge?)

Was time used appropriately?

Did all team members participate equally in the presentation? (Did all team members share the presentation time equally? Did all team members present such that each team member explained a key concept involved in the design?)

Penalties

Misuse of time – under-use by more than 3 minutes -5/minute

Misuse of time – over-use..... -10/minute

Originality..... /15

Does the design differ substantially from other designs?

Was the solution clearly the work of the competitors?

7 Competition Procedures

7.1 Releasing the Statement of Theme

- The Statement of Theme will be published to competitors, judges and the public at least seven (7) days prior to start of the competition.
- Competitors will also receive a list of required materials (if applicable) at this time

7.2 Judges' Briefing

- The Judges' Briefing occurs prior to disclosing the Scope of Work to the competitors
- The Category Official will present the Scope of Work, answer questions about it, and make any final amendments to the problem as required by the consensus of the judges.
- The Category Official will also cover logistics of the competition related to judging.

7.3 Phase 1: Releasing the Problem Statement

- The Category Official, Timekeeper(s), and all competitors and judges must be physically present for Phase 1.
- The Problem Statement, which outlines full details of the problem and judging criteria, will be presented to all competitors and judges on Friday evening of the competition.
- The Category Official will present the Problem Statement orally, as well as handing out printed copies to competitors and judges at this time.
- Logistics of the materials store and final presentation will also be presented at this time.
- The order of presentation will also be announced at this time (see Phase 4 for the method of determining the order of presentation).
- Questions must be held until the Question Period.

7.4 Phase 2: Question Period

- Question Period immediately follows Phase 1, with duration of 20 minutes.
- During this time, competitors can ask the Category Official to clarify any point of the Problem Statement, competition rules or logistics of the competition.
- Only the Category Official may answer questions.
- Questions and answers will be recorded and distributed to the competitors and judges.

- The timekeeper will stop the clock if the judges ask a question and resume keeping time when the Category Official has answered the question.¹

7.5 Phase 3: Development of the Solution and Preparation of Deliverables

- The teams will have six (6) hours to develop their solution, produce all required deliverables, and prepare their presentation for the judges. All the deliverables must be submitted to the Official before the allotted time expires. Competitors may finish before the end of the allotted time without penalty.
- The OEC Organizing Committee should provide additional time if there is a significant travel time between the location of the Question Period and the work rooms used for Phase 3.
- Work presented by the teams must be their own work. The teams may use and cite previously published work with proper referencing. Violations will be ruled on by the Category Official and may be grounds for disqualification.
- Only questions related to the format of the deliverables will be answered during Phase 3. Answers will not be given to any question that might lead to the development of a new approach or that might invalidate a potential solution.
- Questions must be submitted in writing. Answers will be distributed in writing to all teams at the same time. Answers may be provided at scheduled times, or accumulated until a significant number of questions have been asked, to ease logistics.
- Questions will not be accepted during the final 30 minutes of Phase 3.
- Questions and responses from Phase 3 will be provided to the judges prior to the presentations and report reviews.
- Announcements of the remaining time will be made at 1 hour, 30 minutes, and 10 minutes before the end of the allotted time for Phase 3.
- If the final presentation is to be submitted electronically (via USB or email to jr.design@oec2015.ca), it must be submitted to the Category Official any time before the expiry of the six (6) hours.
- Final prototypes must also be delivered to the holding room before the expiry of the six (6) hours. Late deliveries will be assessed a penalty based off Section Penalties outlined in Scoring.

7.6 Phase 4: Final Presentations

- The order of presentation will be determined randomly.
- Each team is given a minimum of five (5) minutes to set up their presentation.
- Each team is allowed 10 minutes to present their solution and deliverables.
- During this time, the team's design will be allowed to demonstrate their functioning prototype but will not be scored for testing at that time. Only the presentation will be scored during the presentation time. Dedicated testing time will follow after the presentations.
- Judges may ask brief questions during the presentation for clarification, but should hold detailed questions until the question period. Time will be halted while a judge asks a question and while the team responds.

¹ Questions from the judges should be kept to a minimum during the Question Period, as their questions should be addressed during the Judges' Briefing.

- The remaining time must be indicated at 5 minutes and 1 minute before the end of the allotted time. A visual countdown must be given during the last 30 seconds of allotted time.
- A five (5) minute question period will follow each presentation during which judges and the general public will be allowed to ask questions, with priority given to the judges' questions.
- The testing session will be after all the presentations. They will be open to the public and the competition commissioners will be scoring the design solely on functionality and requirements of the design. The time allocated for each time for the testing will be disclosed during the briefing session.

7.7 Multi-Stream Judging – Determination of Final Winners

If multi-stream judging is implemented, each panel of judges will present their top four finalist teams to the other panel, and as a total group the judges will decide the outcome. The numeric scores will form the main basis for comparison. In the event of a tie, the team scoring higher on Design & Performance will be given the higher ranking.

University of Toronto	ENG 105 (9:00 AM: 9:30 AM)
University of Guelph	ENG 106(9:00 AM: 9:30 AM)
Lakehead University	ENG 105 (9:30 AM: 10:00 AM)
Western University	ENG 106 (9:30 AM: 10:00 AM)
University of Waterloo A	ENG 105 (10:00 AM: 10:30 AM)
University of Waterloo B	ENG 106 (10:00 AM: 10:30 AM)
Carleton University I	ENG 105 (10:30 AM: 11:00 AM)
Carleton University II	ENG 106(10:30 AM: 11:00 AM)
University of Windsor	ENG 105 (11:00 AM: 11:30 AM)
Laurentian University	ENG 106(11:00 AM: 11:30 AM)
University of Ontario Institute of Technology	ENG 105 (11:30 AM: 12:00 PM)
Ryerson University	ENG 106 (11:30 AM: 12:00 PM)
Lunch & Career Fair	ENG (12:00 PM - 1:00PM)
McMaster University	ENG 105 (1:00PM - 1:30 PM)
Royal Military College of Canada	ENG 106 (1:00PM - 1:30 PM)
Conestoga College	ENG 105 (1:30PM - 2:00 PM)
York University	ENG 106 (1:30PM - 2:00 PM)
Queen's University	ENG 106 (2:00PM - 2:30 PM)

Ontario Engineering Competition 2015 Junior Design

This document contains all details required to build the Junior Design prototype. It is the competitor's responsibility to read over this carefully.

1. Background Information

A new dam is to be constructed in Niagara Falls. A model has been constructed to reflect the key features and locations of the dam. Your team is requested to build a hand operated mechanism which can transport items (supplies) of various loads to different locations (workers) on the dam. The terrain features a large reservoir as well. This must be kept in mind when designing the prototype as some parts of the prototype may be exposed to water. Each team will be provided a set of certain base materials, as well as \$200 (fake currency) to purchase materials from the 'shop' (or 'store').

2. Design Requirements

1. Your design must be self-supporting. i.e. It must be able to support its own weight, in addition to the weight of the loads without any external support (such as your hands).
2. Your design must feature at least one mechanism.
 - a. This mechanism can be used for either translational motion or rotational motion. It is left up to the team to decide how they wish to proceed.
 - b. A mechanism is defined as a system of parts working together in a machine; a piece of machinery. Examples of mechanisms: four-bar links, meshed gears, crank slider, etc.
 - c. A simple pivot is not a mechanism. (please see figure in appendix for examples of what is allowed)
3. Your design must be built on top of the provided base. The design must not exceed the boundary (of 6" x 6") etched on to the wood while in resting position. There is no restriction on height of the mechanism. (There will be no point deduction or bonus for an extraordinarily high mechanism).
 - a. The resting position is defined as the position at which your mechanism is fully self-supported.
4. The controls or your mechanism must not exceed the height of 6" above the base during your design's resting position.
5. While controlling your mechanism, your hand may not go beyond the control boundary (as demonstrated by the competition commissioner)

3. Objective & Scoring

There are 12 objects placed on the arena. Your mechanism must be able to pick up those objects and deliver them to their assigned locations.

- a. 2 Girders
 - i. One of which is to be transported to Location 2 [2.5]
 - ii. One of which is to be transported to Location 4 [2.5]
- b. 2 Cases of bricks
 - i. One of which is to be transported to Location 1 [2.5]
 - ii. One of which is to be transported to Location 5 [2.5]
- c. 2 Empty supply crates
 - i. One of which must be transported to Location 3 [2.5]
 - ii. One of which must be transported to Location 6 [5]
- d. 2 Motors
 - i. One of which must be transported to Location 7 [2.5]
 - ii. One of which must be transported to Location 8 [10]
- e. 2 Spool of cables
 - i. One of which is to be transported to Location 1 [2.5]
 - ii. One of which is to be transported to Location 5 [2.5]
- f. 2 Marbles
 - i. Both of which must be placed inside the empty crates either before or after they have been transported to Location 3 [2.5] each

If the objects are transported to any location other than the ones specified, points will not be given for that specific object.

The competition Commissioner will mark the Design & Performance section during the testing session. The total points in this section are 40 and are solely based off the ability of the team to fulfill the objective (the requirements are mentioned above).

The judges will mark the other sections during the presentation (Team work, Presentation & Originality). The total points for these sections will be 60.

Total points for each team is 100.

Please refer to the rule book for a breakdown of the scoring.

The objects weigh from a range of 50 grams to ~ 300 grams

4. Testing time

Total time per session: 240 seconds (4 minutes)

2. [30 second setup] Each team is allowed a 30 second setup time during which they are not allowed to transport any objects. During this time they must ensure that their design's base is securely fastened into the arena. The team is not allowed to start testing until they hear the buzzer, even if they are ready to go before that.
3. [90 seconds testing] Following the setup time, each team will have 90 seconds to perform the required tasks (transporting objects).
4. [120 second transition] Following the testing for each team is a 60 second transition. During this, the competition commissioner will "reset" the arena and the next team will be called forward. Immediately after this 60 second transition, the 30 second setup will start for the next team.

There will be two arenas (both arenas are in the same room, ENG 103), titled Arena A and Arena B. Each team will be informed if they will be testing on Arena A or B, and it is their responsibility to be present at the arena at the allotted time to the allotted arena.

Arena A = Teams presenting in ENG 105

Arena B = Teams presenting in ENG 106

Please refer to the delegate package or the general schedule to find your presentation room.

There will be no penalty for dropping an object. Each team is allowed to pick up any object they accidentally drop within the arena. If the object is dropped outside the boundary of the arena, it will not be allowed to be picked up.

5. Penalties and bonus for design and testing

- [-5%] exceeding the base dimensions. i.e, building outside the provided 6"x 6" etched surface
- [-5%] If controls exceed the 6 inch height requirement.
- [-5%] per object for damaging any of the objects.(for a maximum of 40%)
- [-0.5%] per second for exceeding the time during testing for a maximum of 10 seconds. After these 10 seconds, the competition commissioner has the right to disqualify the team.
- [-20%] for not incorporating at least one mechanism in the design
- [-20%] for a non self supporting structure
- [-40%] for damaging the arena. Please don't break the arena (in any way).
- [+2.5%] for spending less than \$150 in the store
- [+2.5%] for incorporating more than one mechanism in the design
- [+5%] for completing the test under 30 seconds
- [+ 2.5%] for completing the test under 60 seconds (Note, if a team has already finished under 30 seconds, this bonus will not be applicable)

6. Materials Provided

Only materials provided by the competition commissioner and the materials purchased from the store are allowed to be used for the team's prototype.

- 10 x Popsicle sticks
- 1 x Wooden Dowel (12" x 3/16")
- 1 x Sheet of 3/32" x 3" x 36" Balsa wood
- 2 x glue sticks
- 2 x rubber bands
- 1 x paper clip
- 1 x scissor
- 1 x saw (6" 24 TPI)
- 1 x box cutter
- 30" of string
- 1 x roll of duct tape
- 2 x Push pins

7. Shop items and rules

- [\$50] Sheet of 3/32" x 3" x 36" Balsa wood (limit 1 per team)
- [\$50] Foamboard (limit 1 per team)
- [\$20] Measuring Tape (limit 1 per team)
- [\$15] Wooden Dowel (12" x 3/8") (limit 2 per team)
- [\$10] Wooden Dowel (12" x 3/16") (limit 1 per team)
- [\$10] Screwdriver (limit 1 per team)
- [\$10] Glue stick (limit 5 per team)
- [\$5] Paper clip (limit 10 per team)
- [\$5] Rubber bands (limit 5 per team)
- [\$5] For every 15" of string
- [\$5] For 2 screws (limit 12 screws per team)
- [\$2] Push pin (limit 10 push pins per team)
- [\$1] 1 x Popsicle (limit 50 per team)

1. Each team will be given a 'store card' which will allow access to the store. Only one person from a team will be allowed in the store at a time.
2. Any member of the team may carry the store card.
3. The shop will be closed 10 minutes before the prototype submission deadline. Anyone already in the queue at this time will be allowed to continue with the transactions. Anyone arriving in the queue at or after the last 10 minutes will not be allowed to access the store.

For this period, the time limit of a person staying in a store will be reduced to 2 minutes/team(person) so as to accommodate more people in the queue.

4. Please be considerate of others while in queue and in the store
5. Stealing materials from the store will be an automatic disqualification
6. Bargaining, begging and discounts are not allowed
7. If teams are going over budget, they have the option to substitute their points for currency. The exchange rate is \$1/point.
8. Exchanging materials with other teams is prohibited and will result in an automatic disqualification.

Appendix

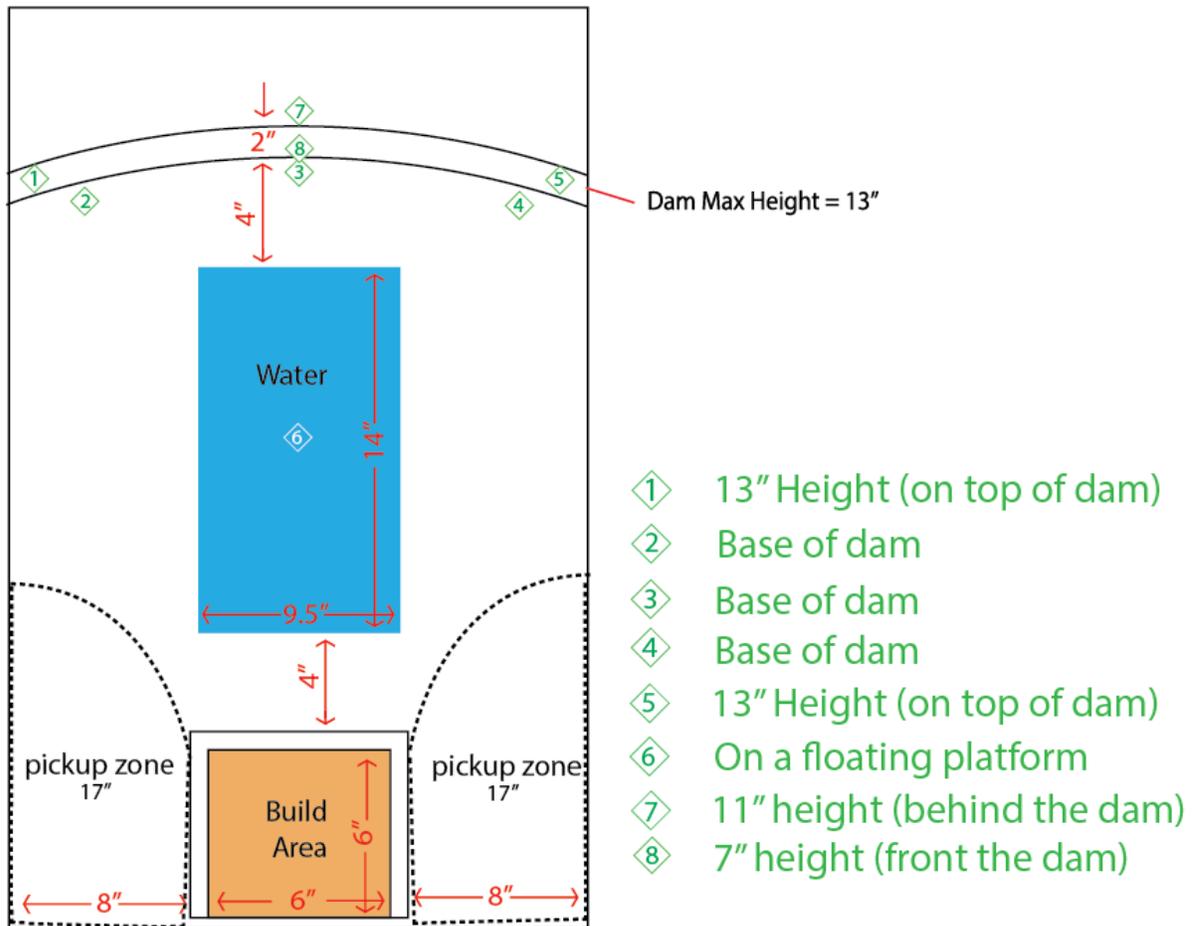


Figure 1. Layout of Arena.



Figure 2. Pivot: Not a mechanism mechanism

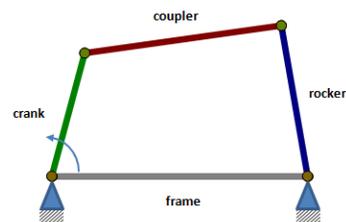


Figure 3. four-bar link as a

Team: _____

Junior Design

Testing	
Girder 1	/2.5
Girder 2	/2.5
Case of bricks 1	/2.5
Case of bricks 2	/2.5
Empty Crate 1	/2.5
Empty Crate 2(water)	/2.5
Motor 1 (Front)	/10
Motor 2 (Back)	/2.5
Marble 1	/2.5
Marble 2	/2.5
Design & Performance Total (marked by commissioner)	/40
Teamwork	/25
Presentation	/20

Originality	/15
Penalties	
Exceeding Base dimensions	/5
Exceeding control dimensions (6" height)	/5
Exceeding testing time (-0.5/second) Max 10 seconds	
Damaging objects (-5 per object)	/40
No Mechanism	/20
Structure not self-supporting	/20
Damaging arena	/40
Exceeding presentation time (-10/min)	
Under-use presentation time (-5/min)	
Bonus	
Completing test under 30 seconds	/5
Completing test under 60 seconds	/2.5
Spending less than \$150 in store	/2.5
Total	/100