



2018 E³ Engineering and Technology Fair

Engineering, Exploration, and Experimentation

Monday, March 26, 2018 Clark Gymnasium at RIT
9:00 am to 1:00 pm

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The E³ Fair Committee is pleased to announce the 27th annual **E³ Engineering and Technology Fair**. The first E³ Fair was held in 1991 and, consistently through each year, it continues to be organized and funded by a joint effort between engineering societies and area industries. The Fair's mission is to increase exposure of engineering and technology related fields (those known as **STEM** – Science, Technology, Engineering, and Math) to middle school students (grades 6 – 8). Students learn the importance of team and process concepts while they are preparing engineering and technology projects which include communicating and making a plan for success. It also allows for creativity and independent thinking. In addition, students learn about careers in engineering from professional engineers at the Fair.

The E³ Fair is from 9am to 1pm with student competitions starting at 9am. When students are not involved in their competition, we encourage them to visit the booths where local engineering societies, colleges and industries will engage students with demonstrations of technology. Students will be eligible for a prize if they visit a designated number of booths.

There are three competition options available to students:

Science / Engineering Project (Option 1): “STEM Project”

Prepare a project or experiment for display that is based on engineering or technology principles.

Simple Machine (Option 2): “Obstacle Course”

Design and construct a machine, using only parts from one Lego kit (model number specified by the E³ Committee), capable of negotiating a track which has been fitted with a number of small obstacles and is inclined at an angle of 10°, in the shortest time possible.

Robotics (Option 3): “A-Maze-ing Robot”

Design, construct and program a robot, using parts from one Lego kit (model number specified by the E³ Committee), to navigate a maze from the Start box to the Finish box in the shortest time possible

The Guidelines for the competition are available on the E3Fair website.

Middle schools in Monroe County and surrounding counties participate in the E³ Fair. If you have participated in past Fairs, we hope to see you again. If you have not previously participated, join in – you will not be disappointed. It is a rewarding and fun experience. Please do not hesitate to contact us with any questions or comments.

Sincerely,

Adelaide Svoboda, Schools Contact Chair
Jayanti Venkataraman, Design Contest Chair

OPTION ONE

GENERAL DESCRIPTION

Projects submitted for Option One will consist of full-size or scale models of a physical structure or device, a detailed description of a process, device, or structure, or data obtained from a project involving experimentation. The presentation of the project at the Fair may include posters, photographs, written work as well as any actual device that may have been constructed. The project and any other supporting data or displays will be placed on the table space assigned to the entrant. This space is limited and the physical dimensions of each entry must not exceed three feet (3 FT) in height, width, or depth; nor may it exceed 30 pounds in weight.

For each grade level, the following topics are suggested to provide a thematic background to the Fair. These suggestions are not intended to limit the students. These are topical areas of wide interest technologically and serve as useful guidelines for the students. If a team of students cares to choose a topic not listed, they may do so at the discretion of the teacher/advisor. Check our web page for updates on Frequently Asked Questions (FAQ).

OPTION ONE *Suggested Topics*

A. ENGINEERING THE ENVIRONMENT

- forms of energy and energy utilization
- preserving our environment; waste disposal and recycling, product packaging
- protecting our atmosphere; global warming, ozone
- how humans and technology impact the environment

B. ENGINEERING FOR EXPLORATION, TRANSPORTATION & COMMUNICATION

- land, sea, air, and space
- communication and communication systems
- robotics, telepresence
- computers and computer technology

C. ENGINEERING FOR HEALTH AND BIOTECHNOLOGY

- genetic engineering
- artificial organs or limbs, medical devices
- food production, processing, storage
- new and novel ways of growing food

OPTION 1

PARTICIPATION AND EVALUATION GUIDELINES

1. The Option One project and all associated presentation materials will be displayed on a table at the Fair. The total physical dimensions are limited to 3ft long x 3ft deep x 3ft high and a maximum weight of 30 lbs.
2. Each group should bring a sign (approximately 30" x 8") displaying the title and grade level. An example for Grade 6 is shown below. This will be taped to the table on which the project is displayed.



3. Students participating in Option One must work under the guidance of a teacher or advisor.
4. Students currently in the 6th, 7th, or 8th grades are eligible to submit a project to the E³ Fair. Those participating may consult any resource at their disposal during the design period, however all hands-on work must be done by the group members.
5. Option One projects may not contain any projectiles or flammable fuels of any sort. This includes but is not limited to gasoline, kerosene, and any acids or bases. The use of electricity is permitted and 120V power will be provided if requested on the Option One Registration Form.
6. Projects that have been part of a classroom activity or another competition or Fair, may be entered by the group that designed and built them.
7. Members of a team must belong to the same grade level.
8. The maximum number to a team is four students.
9. There is no limit to the number of eligible student groups that may participate in Option One of the E³ Fair from any one school.
10. A Judging Committee will determine the winners in each grade level. The Committee's decision is final.

Note: For questions / clarifications of the rules, please contact the Chair of the Design Contest Committee.

OPTION TWO – OBSTACLE COURSE

GENERAL DESCRIPTION:

Option Two involves an open-ended, hands-on, problem solving activity. Participants will solve the problem, build their solution, bring their solution of the problem to the Fair and participate in a competition.

PROBLEM STATEMENT

Design and construct a machine, using only parts from one Lego kit (model number specified by the E3 Committee), capable of negotiating a track which has been fitted with a number of small obstacles and is inclined at an angle of 10° . The track will be provided at the Fair. The machine will be placed on the track, and must support itself without falling over. The vehicle must successfully negotiate the entire course, from “start to “finish” in order to properly qualify for the competition. The time of the run, from a marked start and finish line, will be recorded. The shortest elapsed time will be considered the first place vehicle. The layout of the track is shown in the diagram below.

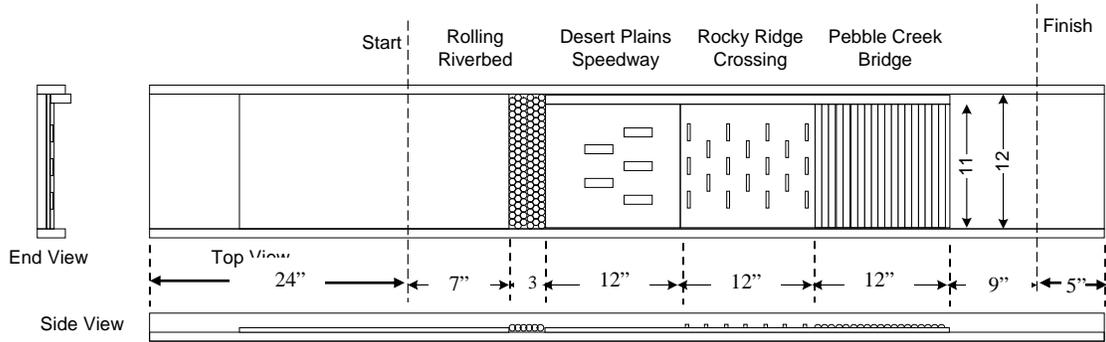
TOURNAMENT GUIDELINES

1. Only parts contained within one LEGO Simple and Motorized Mechanisms Base Set may be used for the project, that is #779686 or #9686. Older kits needing the newer motor can be upgraded by getting the Power Functions M-Motor #8883, the Battery Box #8881, and the Power Functions 20” Extension Wire #8871.

Please contact the Design Contest Chair for questions regarding the admissibility of a kit, if not specified in the list above.

2. Neither the box the kit comes in nor the instruction manual furnished with the kit or any parts from additional kits may be utilized to obtain a solution.
3. No part may be cut, sanded, whittled, polished or physically altered in any way.
4. No oils, adhesives, tape, glues or chemical additives of any type may be introduced as part of the problem solution.
5. The device must rest on the track surface during the competition and must support itself.
6. The battery pack must be attached to the vehicle and cannot be held by the team members.
7. The maximum time for the run is 30secs.
8. The vehicle must successfully negotiate the entire course, from “start to “finish” in order to properly qualify for the competition.
9. Once the vehicle has been initiated, it must continue, without human intervention, until the run is complete.
10. The team will be allowed two *timed* runs. The best of the two times will be recorded for the competition. Between the two timed runs, minor adjustments to the vehicle will be allowed. This should be done without adding or removing parts or changing the configuration. The time for such adjustments would be limited to 2 minutes.

Option II Obstacle Course Track Drawing.

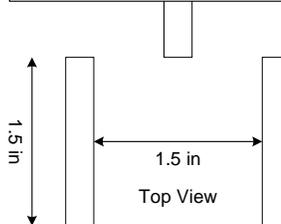


NOTE: This obstacle course inclines at a slope of roughly 10 degrees from start to finish. Drivers beware!

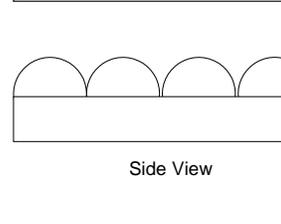
Rolling Riverbed
Created with a 3 inch by 12 inch section of loose marbles. A large starting platform of 3/8 inch thick by 24 inch plywood forms one edge of the river bed. The Desert Plains Speedway forms the second edge.

Desert Plains Speedway
Created with a 3/8 inch thick 12x12 inch plywood with 5 wedges. Wedges are 2.5 x 0.75 inch, 0.25 inch at one end tapering to 0 inch at the other end.

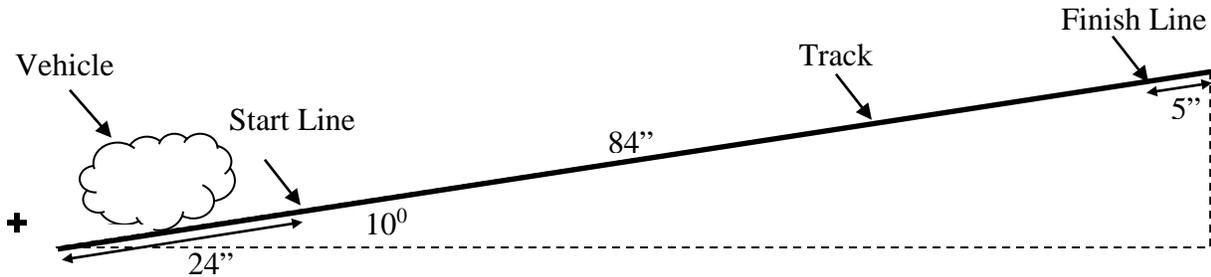
Rocky Ridge Crossing
Created with 18 pieces of 1/4 by 1/4 by 1.5 inch rectangular blocks.



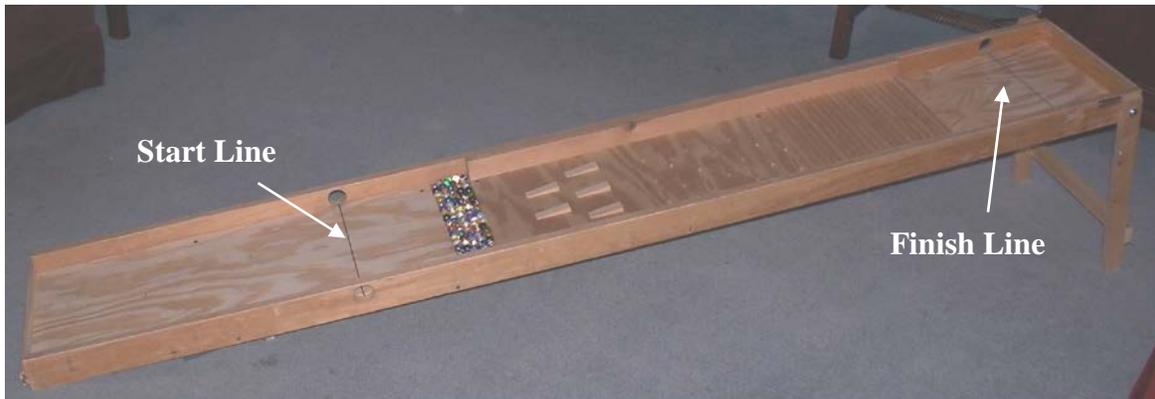
Pebble Creek Bridge
Created with 19 pieces of 11 inch by 5/8 diameter dowels cut in half lengthwise.



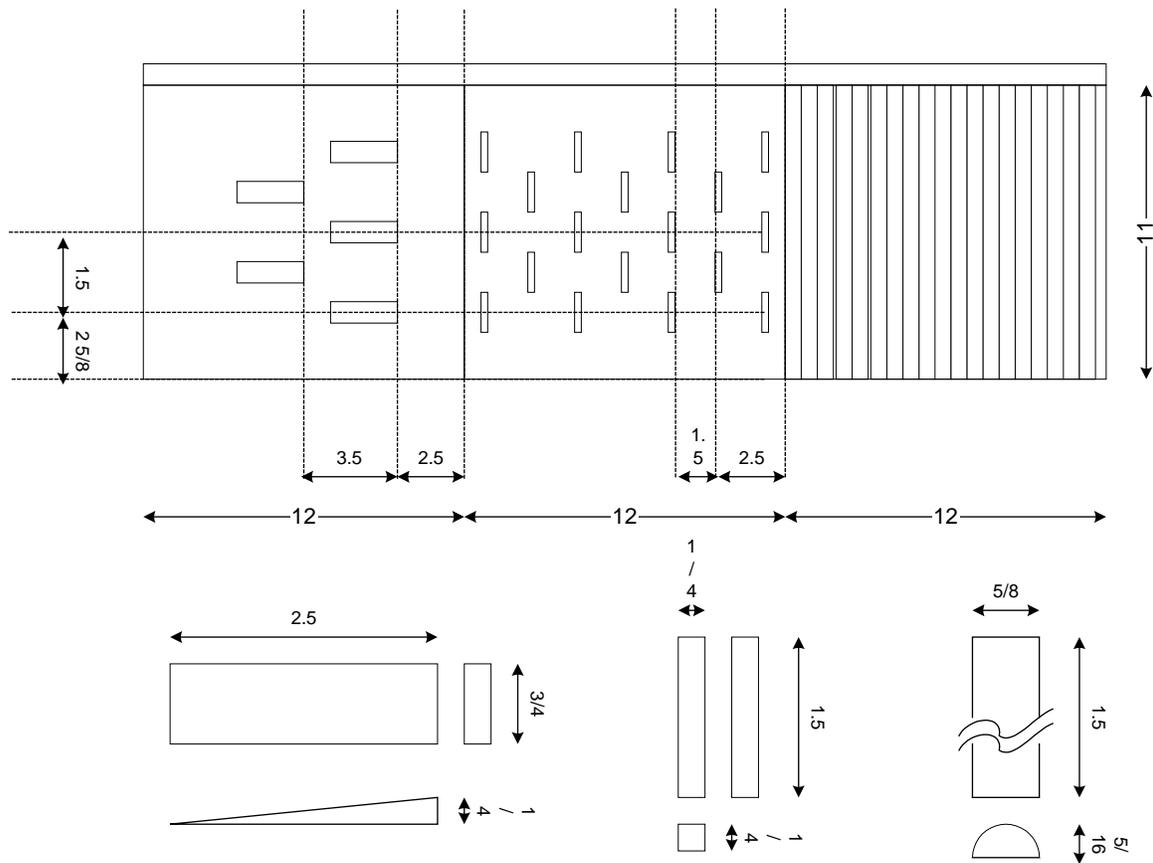
Obstacle Course Track Details



Track inclined at 10°



Option II Obstacle Course Details.



All dimensions are in inches



11. All design decisions and assembly of the Lego parts shall be performed by the students on the team. They may consult any resource at their disposal for guidance or clarification, such as teachers and mentors while working through the problem solving process.
12. There is no limit to the number of eligible student groups that may participate in Option Two of the E³ Fair from any one school. ***However, the number in each group, is limited to a maximum of four.***
13. Decisions made by the Design Contest Chair are final.

OPTION THREE: A-MAZE-ING ROBOT

GENERAL DESCRIPTION

Option Three involves a robotic design, computer controlled, hands on problem solving activity. Participants will solve the problem, build their solution, bring their solution of the problem to the Fair and participate in a competition.

PROBLEM STATEMENT

Design, construct and program a robot, using parts from one Lego kit (model number specified by the E3 Committee), to navigate a maze from the “Start” box to the “Finish” box. The playing field is a square of 48 inches, in which there are walls most of which are constructed in wood and some parts are black electrical tape. The robot will be placed in the ‘Start Box’. The robot should fit in the Start Box and its size, shape and orientation should not change after it has been initiated. During the entire competition its size should be such that it fits in the Start Box. The robot cannot climb over any wall or cross any tape except the ones across the “Start” and “Finish” boxes. The winner is the team that navigates the maze in the shortest time.

TOURNAMENT GUIDELINE

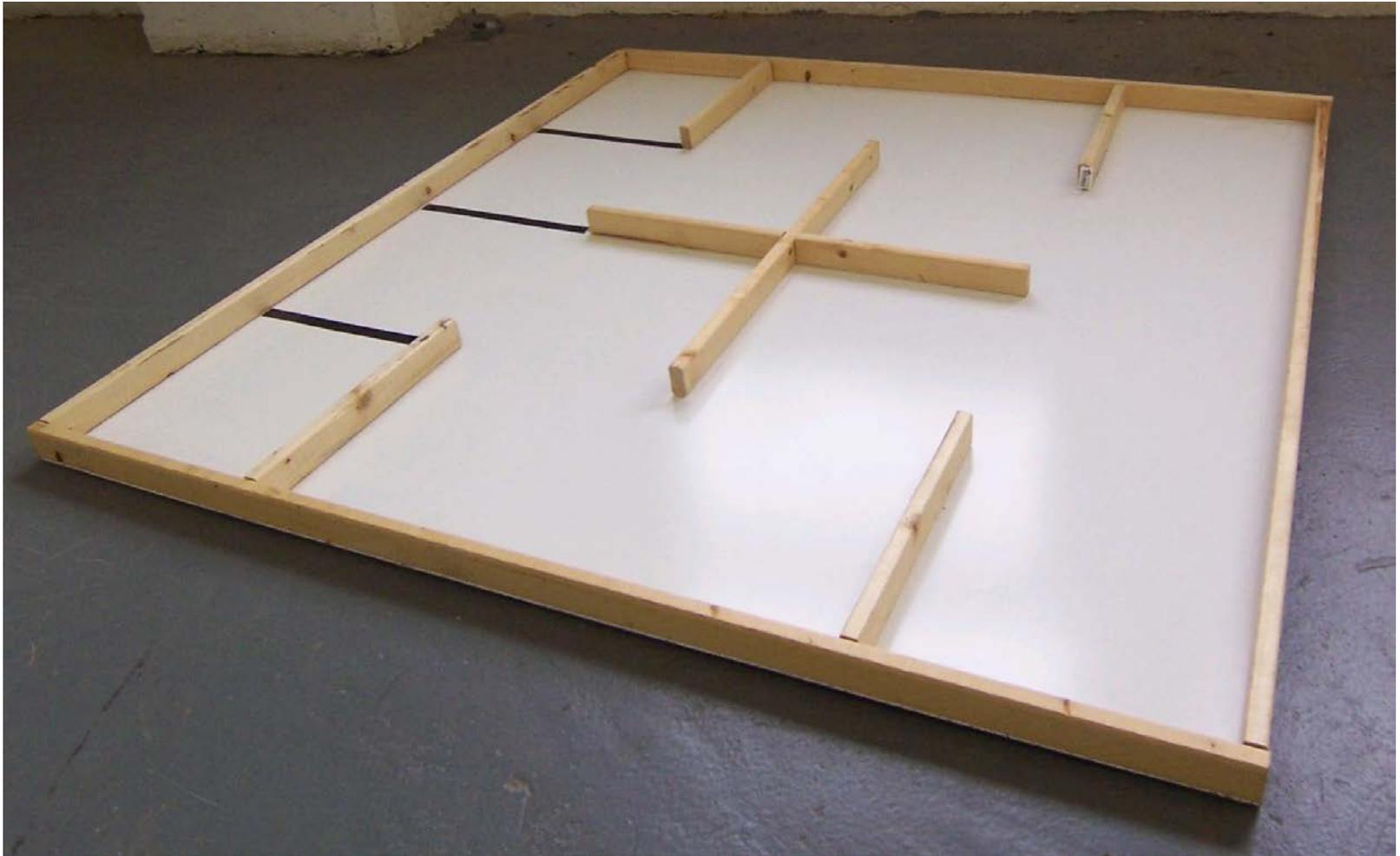
1. Only parts contained within any **ONE** of the following LEGO Mindstorms kits maybe used.
 - Mindstorms NXT kit # 979797 with software version 2.1
 - Mindstorms NXT kit # 5003402 with software version 2.1
 - Mindstorms NXT kit # 991308 with software version 2.1
 - Mindstorms NXT software #2000080 or #900080 (equivalent to version 2.1)
 - Mindstorms EV3 core kit #5003400, using software #2000045
 - Mindstorms EV3 core kit with software #5003462
or free software download from www.legoeducation.com/downloads

Participants may choose to use Robolab Team Challenge set #979794 instead, accepting the fact that the motor in the NXT and EV3 kits are more powerful and robust.

Lego Education no longer carries NXT products. You may still use the specified NXT kits/software for this year’s E3 Fair.

Please contact the Design Contest Chair for questions regarding the admissibility of a kit, if not specified in the list above.

2. No part may be cut, sanded, whittled, polished or physically altered in any way.
3. No oils, adhesives, tape, glues or chemical additives of any type may be introduced as part of the problem solution.
4. The diagram of the ‘Playing Field’ is shown below. It is a white masonite hardboard that is 1/8-inch thick. All the walls are 1x2 wooden furring strips that are 1¾“ in height and ¾” in width. These can be screwed down to the masonite board. The black lines are PVC black electrical tape ¾” in width. It is best not to stretch the tape as it is being applied. The 2 ft by 2 ft crossed walls in the center of the playing field are centered on the masonite board.



Maze Layout

5. The robot will be placed in the ‘Start Box’. It should fit in the Start Box and its size, shape and orientation should be maintained during the entire competition once it has been initiated. During the entire competition its shape, size and orientation should be such that it fits in the Start Box. It cannot change its orientation and become elongated or grow in size. At anytime during the entire competition, the orientation that it competes in should be such that it fits in the Start Box.
6. The clock will start when the team members initiate the robot. The robot has to cross the tape of the “Start Box” to get on the Playing Field. Once the robot has been initiated, it must continue, without human intervention, until the round is complete.
7. The robot has to be completely in the “Finish Box”, to end the round. The Stop Time will be established when the robot completely clears the inner edge of the “Finish Line”.
8. The robot cannot cross the tape that is placed equidistant between the “Start Box” and the “Finish Box”. (See diagram for clarification). It has to navigate through the maze.
9. The robot cannot climb over any wall. It has to navigate around the walls.
10. The winner is the team that navigates the maze in the shortest time.
11. Each team is allowed two rounds. The better of the two times will be considered.
12. All design decisions, journal entries, and assembly of the robot must be performed by the students on the team. They may consult any resource for guidance or clarification, such as teachers and mentors, while working through the problem solving process.
13. There is no limit to the number of student groups that may participate in Option Three from any one school. However, the number in each group is limited to a maximum of four.
14. Decisions made by the Design Contest Chair are final.

PRIZES

Results will be announced at the end of the Fair. Trophies will be awarded to top performers.

Additional Activities at the E3 Fair

There will be a number of informational booths sponsored by various technical engineering societies, local industries and area colleges and universities. These booths are intended to illustrate various aspects of engineering, science, and technology and inform both participants and visitors to the Fair, of career opportunities in a wide variety of technical fields.

Each student will receive a card with a complete listing of the booths. When the student participates in the activities at a booth, the card will be stamped by the booth presenter. When a specified number of stamps are acquired on the card, the student will receive an E3Fair gift at the Rochester Engineering Society booth

E³ FAIR - OPTION ONE
PROJECT REGISTRATION FORM

www.e3fair.org

One copy of this registration form must be completed for each Option One project being entered in the E³ Fair and submitted no later than **February 23, 2018**.

Please mail or email completed forms to: Dr. Adelaide Svoboda
70 Brandywine Lane,
Rochester, NY 14618
ajsvodod@gmail.com

Grade: _____

Name(s) of student(s)

1. _____
2. _____
3. _____
4. _____

School and address: _____

Sponsoring teacher/advisor: _____

Phone Number: _____

email : _____

Title of Project: _____
(60 characters max)

Anticipated special requirements: _____
(120-volt electrical power, compressed air, etc.)

E³ FAIR - OPTION TWO
PROJECT REGISTRATION FORM

www.e3fair.org

One copy of this registration form must be completed for each Option Two project being entered in the E³ Fair and submitted no later than **February 23, 2018**.

Please mail or email completed forms to: Dr. Adelaide Svoboda
70 Brandywine Lane,
Rochester, NY 14618
ajsvod@gmail.com

<u>Name</u>	<u>Grade:</u>
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____

School and address: _____

Sponsoring teacher/advisor: _____

Phone Number: _____

email : _____

E³ FAIR - OPTION THREE
PROJECT REGISTRATION FORM
www.e3fair.org

One copy of this registration form must be completed for each Option Three project being entered in the E³ Fair and submitted no later than **February 23, 2018**.

Please mail or email completed forms to: Dr. Adelaide Svoboda
70 Brandywine Lane,
Rochester, NY 14618
ajsvod@gmail.com

<u>Name</u>	<u>Grade:</u>
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____

School and address: _____

Sponsoring teacher/advisor: _____

Phone Number: _____

email : _____