ROBOT ARM B/C

1. **DESCRIPTION**: Participants will design, build and test a robotic arm similar to industrial robots prior to the competition. This arm will be capable of sorting objects.

   A TEAM OF UP TO: 2 **IMPOUND:** No **EYE PROTECTION:** #5 **APPROX. TIME:** 10 mins.

2. **CONSTRUCTION PARAMETERS:**
   a. Each team may enter only one robot that must be built prior to the competition.
   b. The robot may be controlled remotely by radio control, infrared, or a control box with wires leading to the robot.
   c. All parts of robot, with the exception of the control box and any wires connecting the control box to the robot, must initially fit within an imaginary box (30 cm x 30 cm) with no height restriction.
   d. The robot must stand on a stationary base and fit inside a 30 cm x 30 cm square.
   e. The robot may have any number of arms and joints.
   f. All robot motion must be powered only by electrical, elastic, fluidics, gravitational energy, hydraulics or pneumatics.
   g. Commercially labeled batteries not exceeding 9.6 volts must energize each robot circuit. If multiple batteries are used, they may be connected in series or parallel as long as the voltage output does not exceed 9.6 volts.
   h. Each robot function may have an independent circuit, source of electrical energy and control mechanism.
   i. Radio control equipment used for this event must operate on frequencies designated by FCC regulations for surface devices. The frequency must be marked by the manufacturer on the transmitter. Allowable frequencies are: 75 MHz band (75.41 through 75.99 MHz) which contains 30 channels, 27 MHz band (26.995 through 27.255 MHz)**, or** 49 MHz band (49.8302 through 49.890)**. No other frequencies may be used. Robots using other frequencies will not be allowed to compete.**

3. **COMPETITION AREA:**
   a. The competition area will be an 80 cm x 80 cm square. The inside edge of tape will be used to mark the competition area. The tape defining the competition area is counted as outside the competition area. The event supervisor will designate each of the 4 sides as North, East, South, and West in a compass arrangement.
   b. A 30 cm x 30 cm square (called the "Robot Square") will be placed inside the competition at the center of the southern edge. Tape will be used to mark the inside edge of the Robot Square.
   c. At the centers of the western, northern and eastern edge, there will be a bottom portion of a half gallon milk jug (called "Goal Box") placed inside the competition area and cut to a height between9.5 and 10.5 cm with the opening facing up.
   d. The tape's northern edge will divide the competition area into the North Zone and South Zone along the 40 cm center line between the East and West Goal Box.
   e. 5 "½ inch PVC pipes" 9.5 – 10.5 cm long, 5 ferromagnetic nails 9.5 – 10.5 cm long, and 5 unsharpened #2 pencils will be spaced 7.5 cm apart and placed in a row perpendicular to the edges of the Robot Square. The head of each nail, the eraser end of each pencil, and either end of each PVC pipe will touch the edges of the Robot Square, and each item will point away from the Robot Square.
   f. The pencils will be placed along the western edge, the nails along the northern edge and the PVC along the eastern edge. There will be four upright D batteries centered between each pair of nails with the positive terminal (nub) facing up.
   g. There will be an unmodified half gallon jug with the cap removed (called the "Bonus Box") placed at one of the two northern corners of the competition area.

4. **COMPETITION:**
   a. The robot's base must be placed within the Robot Square.
   b. Teams will have 5 minutes to set up and test their device, and 3 minutes to complete the task of moving the scorable items.
   c. The Event Supervisor will say "3, 2, 1, Go," and timing will start on "Go". The run will stop if any of the following occur:
      i. 3 minutes have elapsed
      ii. The team says "Stop"
      iii. The team steps into the playing field after being warned once

iv. The team touches the robot
v. Any part of the robot base leaves the 30 cm x 30 cm center square (including liquids)
vi. The robot is physically moved by the wires connecting it to a control box

d. Teams who wish to file an appeal must leave their robot and controls with the Event Supervisor.

5. **SCORING:**

a. If the students or control wires move any of the scorable items (pencils, nails, PVC pipes, batteries), or if any scorable item touches the ground outside of the competition area, even if it is under the control of the robot arm, that item will be out of play and may not be used to attain any points.

b. Teams will receive the following points for each of the following items supported only by the following Goal Boxes at the end of the run. Points attributed to an item in the Goal Box will only be counted if that item was placed inside the Goal Box while the box was not on its side.

	West Goal Box	North Goal Box	East Goal Box
Pencil	3	2	2
Nail	2	3	2
PVC	2	2	3

c. 4 points will be awarded for each Goal Box that completely supports any number of D batteries. (12 points max)

d. At the end of the run, any item that is completely within the North Zone and not completely supported by one of the Goal Boxes will receive 1 point.

e. 10 bonus points will be awarded for each type of item (except batteries) completely in the Bonus Box. (30 points max)

f. 5 points will be awarded for each Goal Box that did not lie completely sideways any time during the run. (15 points max)

g. The maximum number of points possible is 93

h. The team with the most points will be the winner. Tie Breaker 1: Fewest number of motors used. Tie Breaker 2: shortest run time wins.

i. Tier 1: Robots that meet all requirements
Tier 2: Robots that fail to meet any of the specifications under "Construction parameter"
Participation Points only: Robots that violate the frequency rules (see 2i)