** MESA DAY RULES**

**2022-2023**

**(FINAL – REVISED 1/9/23)**

**Prosthetic Arm**

**LEVEL:** Community College

**DIVISION(S):** Community College All

**COMPETITION: Competition location will be at** [**University of the Pacific A.G. Spanos Center**](https://goo.gl/maps/DQuiLZBm3Hys9RBh7) **11am-2:30pm on Saturday, March 4th 2023. Please register your team for the competition at:** [**https://forms.gle/TTwJoxQwYv6iRQVS8**](https://forms.gle/TTwJoxQwYv6iRQVS8)

**COMPOSITION OF TEAM:** 2-3 students per team

**SPONSOR:** University of the Pacific MESA. Please contact Elana Peach-Fine at [epeachfine@pacific.edu](mailto:epeachfine@pacific.edu) with any questions!

**OVERVIEW:** Students will design, construct, and operate a simulated prosthetic arm that can grab, stack, and release plastic cups into a pyramid in the fastest time. **Here are several examples of past prosthetic arms:** [**https://www.youtube.com/watch?v=XgFnV\_esdzM**](https://www.youtube.com/watch?v=XgFnV_esdzM)[**https://www.youtube.com/watch?v=fXModvWLnc8**](https://www.youtube.com/watch?v=fXModvWLnc8)[**https://www.youtube.com/watch?v=UdBfRfWUX7g**](https://www.youtube.com/watch?v=UdBfRfWUX7g)



**MATERIALS:** For the device, all materials are legal with the exception of hazardous materials. There are no cost limitations; however, awards will be given to the most innovative designs utilizing low-cost materials.

The Host Center will provide the following:

* 21 – Red Solo Cups 16-ounce plastic cold cups from Amazon or equivalent
* Dryer Sheets

**GENERAL RULES:**

1. The students’ full name, grade level, and school name must be clearly labeled on the device. A 10% penalty in the score will be assessed for failing to properly label.
2. The device must have at least two artificial fingers. These fingers:
   1. MUST open and close. At least two fingers are required to move.
   2. MUST grab, stack, and release the plastic cup into a pyramid. Team member may NOT use any other part of the prosthesis or parts of his/her own hand, wrist or arm to grab and release the plastic cup.
3. The device must NOT be controlled or operated by either of the team member’s fingers, hands, or wrists.
4. In order to simulate an amputated arm, participating team member must have his/her wrist, hand, and fingers immobilized during the competition. The team will determine own method for immobilization.
5. The device (i.e., artificial fingers) may only grab, stack, and release ONE plastic cup at a time.
   1. A plastic cup that is dropped on the table or floor, knocked over, knocked off the pyramid, etc. must be grabbed by the artificial fingers before attempting to replace it onto the pyramid.
6. During the trial, the team member may use his/her unencumbered hand (i.e., non-prosthetic) to hold and move the original pre-stack of cups, but the bottom must remain in contact with the table at all times.
7. Digital media (e.g., photos, video recordings, etc.) will not be accepted for arbitration purposes.

**JUDGING:**

1. Devices will be checked for specifications prior to the start of the competition. Disqualified teams after this initial check will have an opportunity to compete if they meet ALL of the following conditions:
   1. Accept an automatic “Mistrial” and therefore no score for Trial #1.
   2. Make repairs/modifications as necessary to bring the device to proper specifications and be ready to compete when called for Trial #2.
   3. Make repairs/modifications only in the designated area as indicated by the judges.
   4. Failure to adhere to any of a, b, or c will result in the disqualification being upheld.
2. Teams that are not disqualified but wish to make repairs and modifications may do so, but they MUST be ready to compete when called for Trial #1.
   1. Repairs are only allowed with duplicate parts and materials.
3. Each device will be allowed two (2) non-consecutive trials.
4. At the beginning of each trial, team member must demonstrate immobilization (see Rule 4).
5. Each device must be ready when called or team will forfeit that trial.
6. Each team will be given up to 60 seconds to prepare, attach, and demonstrate prosthetic arm, and to prepare the pre-stack of 21 plastic cups facing down anywhere on the table (i.e., the lips of the cup facing down). Preparing the cup stack includes treating cups with dryer sheets and placing stack cups in the preferred position. (Note: other team members can assist with treating the cups with the dryer sheets). If at the end of the 60 seconds the team is not ready, the trial will be declared a mistrial and this process will be repeated for the second trial.
7. The judge will give the start order and begin the timer.
8. The team member will enter the *Working Area* and will have a maximum of 1 minute (60 seconds) to grab, stack, and release the plastic cups into the tallest pyramid. The judge will notify the team when 30 seconds, 20 seconds, and 10 seconds remain.
9. The judge will stop the timer when the last plastic cup has been placed onto the pyramid. Or, the judge will call “time” after one minute has passed.
   1. The judge will record the time needed to complete the trial.
   2. The judge will count the number cups successfully stacked on the second tier or higher (i.e. cups still stacked at the end of the trial).

**SCORING:**

1. Team points-to-time ratio = total points divided by trial time in seconds (00.00)
   1. 20 points awarded for each plastic cup on the second tier or higher; plastic cups on the first tier will NOT earn points (maximum of 15 cups x 20 = 300 points)



No points earned for first tier cups.

* 1. Time needed to complete trial (maximum of 60.00 seconds)

1. Maximum of 4 points awarded for sketches and materials table
2. Final Score = best points-to-time ratio
   1. The best points-to-time ratio of the two trials will be used

**AWARDS:**

* 1st place participants will receive $300/per team member, 2nd place participants will receive Pacific hooded sweatshirts, 3rd place teams will receive $10 starbucks gift cards. All prize winners will also receive medals.
* Ribbons will be awarded for Innovative Engineering Design utilizing low-cost materials.

**ATTACHMENTS/APPENDIX:**

* Competition Area Specifications
* Equipment
* Inspection & Score Sheet for Prosthetic Arm

**Competition Area Specifications**

* A standard six-foot table with approximate dimensions of 180 cm (L) x 74 cm (W) x 75 cm (H).

***Task Area***

(60 cm)

***Table / Task Area***

***Working Area***

74 cm

180 cm

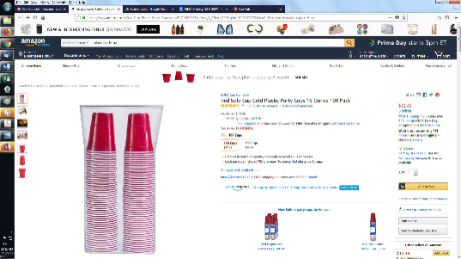
* A perimeter of approximately one (1) meter around the table will be marked with tape. Only the team member actively participating during the trial will be permitted in this *Working Area*.

**Equipment**

* 21 pre-stacked Red Solo 16-ounce plastic cold cups from Amazon

(Link to cups on Amazon <https://goo.gl/Rw85ga>) or equivalent

recommend additional plastic cold cups as replacements)

* Standard six-foot table
* Measuring tape
* Masking tape to outline the *Working Area*
* 1 stopwatch to record trial time
* *Dryer Sheets – Bounce ‘Free and Soft’*

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**INSPECTION AND SCORE SHEET FOR PROSTHETIC ARM**

**Community College**

*Copies of this inspection and score sheet will be provided by the MESA Day Host Center.*

Student Names: Grade: **Community College**

School: MESA Center:

**Section below to be completed by Judges**

**INSPECTION LIST: YES NO**

Device includes at least two artificial fingers that open and close (at least 2 fingers are required to move)

Fingers grab and release cups

Device not controlled by fingers, hands, or wrists of either hand

Team has demonstrated immobilization of the fingers, hand, and wrist

Device labeled properly (students’ full name, school name, grade and MESA Center)

**Innovative Engineering Design (ranking – 1, 2, 3, etc.):**

**TRIAL 1.** # of cups: x 20 = ***(count ONLY cups on second tier or higher)***

Trial Time (00.00 seconds): Cup Pts/Time Ratio:

Mistrial (reason):

**TRIAL 2.** # of cups: x 20 = ***(count ONLY cups on second tier or higher)***

Trial Time (00.00 seconds): Cup Pts/Time Ratio:

Mistrial (reason):

**Final Score** (best of two trials + Sketches/Materials Table Points)

Device Labeling Penalty (10% of Final Score) -

**GRAND TOTAL SCORE**