



marine technology
SOCIETY

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Aligarh Muslim University
IEEE STUDENT BRANCH

MTS AUV-ZHCET presents

AMU ROV CHALLENGE

Organised by MTS AUV-ZHCET and IEEE.



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1. Objective

AMUROV is a national-level student competition established to generate, cultivate, and enhance a community of innovators capable of making substantive contributions to the Remotely Operated Underwater Vehicles (ROVs) domain.

Participants tackle fundamental challenges in the design of ocean systems capable of changing the world — while getting hands-on experience by designing, building and testing a remotely operated underwater vehicle. By providing a venue and mechanism to share knowledge and innovate, students are primed for jobs in developing, testing and managing state-of-the-art systems.

2. AMUROV Information and Updates

AMUROV Forum

All technical questions, comments, and suggestions should be posted on the 2023 **AMUROV** Forum. Teams are encouraged to actively participate in the online community and monitor it for the latest news and updates regarding all things.

Points of Contact

- ORGANIZERS –
 1. MTS AUV-ZHCET, AMU : auvzhcet@zhcet.ac.in
 2. IEEE, AMU : ieeestudentbranch@zhcet.ac.in

3. Schedule

AMUROV 2023 will be hosted offline. All venue, tasks, vehicle guidelines and descriptions included in this document are meant to guide competition submissions and will be executed on 4-5 march, 2023.

4. Official AMUROV Competition Website

The official competition website is <https://amurov.co.in/>. The documents posted at [AMUROVc](#) website are the official documents for this competition. All documents referenced here and in other **AMUROVc** documents are available at the official competition website. These documents are updated regularly. It is the teams' responsibility to check the website for the most recent revisions.

5. Registration Information

To participate in the competition, all teams must register through the official **AMUROVc** 2023 website.

This registration collects team contact information, an optional team bio and logo and the required registration fee (for UG Students).

6. Competition Categories

There are two broad categories of the competition namely:

- 1) School level: The school level competition will be conducted in two levels -
 - Level 1 : Classes 6-8th - **Poster making** competition. Refer to 7.2
 - Level 2 : Classes 9-12th - **Science Exhibition**. Refer to 7.2
- 2) Undergraduate(UG) level: The undergraduate level competition will require the physical presence of the team including the

prototype or the culminating hardware solution that the team has created.

7. Team Deliverables (Design Documentation)

Structure of the Team

7.1.1. School Level - 1 (6-8th)

- Individual poster making i.e only one poster per student.
- Students can be from any school.
- A3 or A2 size paper for poster making.
- Submit ID proof (school ID) along with submission.

7.1.2. School Level - 2 (9-12th)

- Maximum 4 students can participate in a team.
- Individual participation is also allowed.

7.1.3. Undergraduate Level

- Maximum 8 students can participate (including team head).
- A team mentor (who needs to be a faculty advisor/master's student).
- Students must be of the same school/college.

For School Level

- A3 or A2 size paper for poster making
- Submit ID proof (school ID) along with submission (for both levels)

7.1.4. LEVEL - 1 : Themes for posters

- *Problem of Plastic Pollution in Oceans.*
- *Impact of climate change around the Globe.*
- *Maintaining healthy Waterways*

7.1.5. LEVEL - 2 : Science Exhibition

- *Eco Friendly Electricity.*
- *Waste Water Management & Recycling.*
- *Robotics.*

For Undergraduate Level (UG)

7.1.6. Video Submission

The maximum length of the video should not be more than 1 minute, in which the team should show at least 30 seconds of maneuvering inside a pool, demonstrated by one of their team members.

7.1.7. Technical Design Report (TDR)

The report should start by an introductory page containing the structure of the team and relevant information. Other important areas to mention but not limited to:

1. Specifications of the ROV including: weight, dimensions etc.
2. Technical details including: Battery and power consumption, buoyancy etc.
3. Design CADs/ 3D drawings/ CFD Simulations/ MATLAB Simulink Simulations/ Circuit diagrams/ Pictures etc.
4. Details of the sensors and software used.

5. Procurement Report: It should contain the details of manufacturing cost, providing a clear overview of the budget plan.
6. The report should be submitted in both pdf and word file format.

8. Competition Overview (UG level)

Venue

- Level 1 and 2 - Zakir Husain College of Engineering and Technology (ZHCET) lawns, Aligarh Muslim University, Aligarh.
- UG Students - Yusuf Ali Aquatic Complex, Aligarh Muslim University, Aligarh.

Registration Fees

- Level 1 - Rs. 100 per student
- Level 2 - Rs. 200 per model
- UG Students - Rs. 5000 per team

Specifications of ROVs

8.1.1. Weight and size constraints

Competition officials will use the following chart to award points for size and weight:

L=Length
B=Breadth
H=Height

SIZE (in cms)		Weight (In Air)	
L<75, B<65.01, H<60.01	+ 10 points	< 20 kg	+10 points
75<L<100, 65.01<B<75.01, H<69.9	+5 points	20.01 kg to 28 kg	+ 5 points
L>100.01, B>75.01, H>69.9	No points	28.01 kg to 35 kg	+0 points

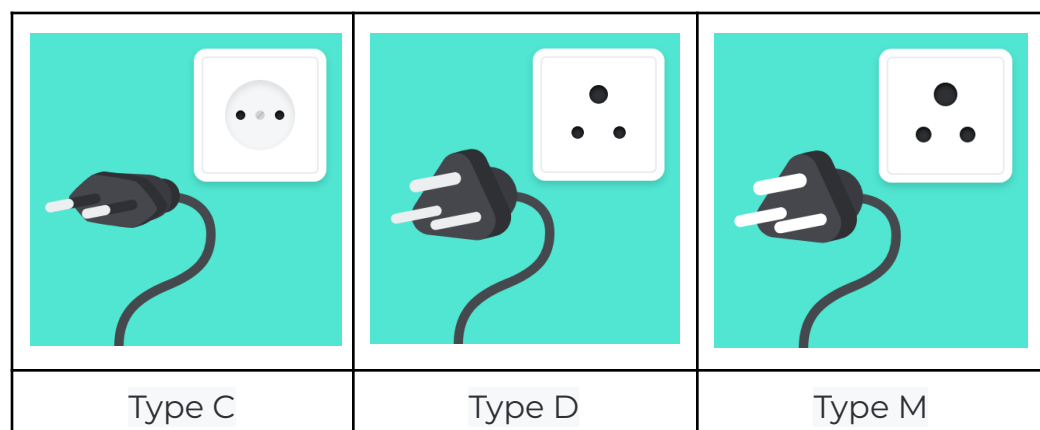
Vehicles greater than 35 kg in weight, will not be allowed.

8.1.2. Design, software and manufacturing

- The team shall be awarded 10 points on having the innovative and robust design of their ROV.
- The team shall be awarded 10 points on using self manufactured components in their ROV, that can be thrusters and Hull.
- The Team which will be using ROS for completing the tasks shall be awarded 10 points.

8.1.3. Power

India operates on **230V supply voltage** and **50Hz frequency**. In India there are three associated plug types, types C, D and M. Plug type C is the plug which has two round pins, plug type D is the plug which has three round pins in a triangular pattern and plug type M is the plug which also has three round pins



There should also be proper use of **fuses** in the vehicle concerning the safety standards. In addition to it, there should also be an external **kill switch** to stop the working of the vehicle completely.

Length of tether should be decided by the teams themselves after going through the dimensions of the pool and the different task descriptions. Around 50m would be sufficient.

8.1.4. Safety

- ROVs must be designed and manufactured as to pose no danger of any kind to anyone or anything at the venue.
- ROVs must not leak and pollute the pool.
- Pressure of any compressed gas used must not exceed 6 bars.
- The use of explosives, fire or hazardous chemicals is prohibited. Certified lithium batteries are allowed.
- If lasers are used, they must be of class 2 or lower. Care must be taken to protect all persons at the venue from harm. Beams must be oriented in such a fashion that they cannot shine into the eyes of the spectators.

Balloons

Balloons of radius 10cm will be used in Task-2

9. Competition Requisites (Applicable for UG Level only)

All the participating teams are imperatively required to bring their own tether cables for the completion of the appropriate tasks.

10. Tether Cable Length

The specified length of the tether cable to successfully complete each task is **50 meters**.

11. Competition Rules (UG level)

Rule 1 : The official source for all information concerning rules, interpretations, and information updates for AMUROV is at :

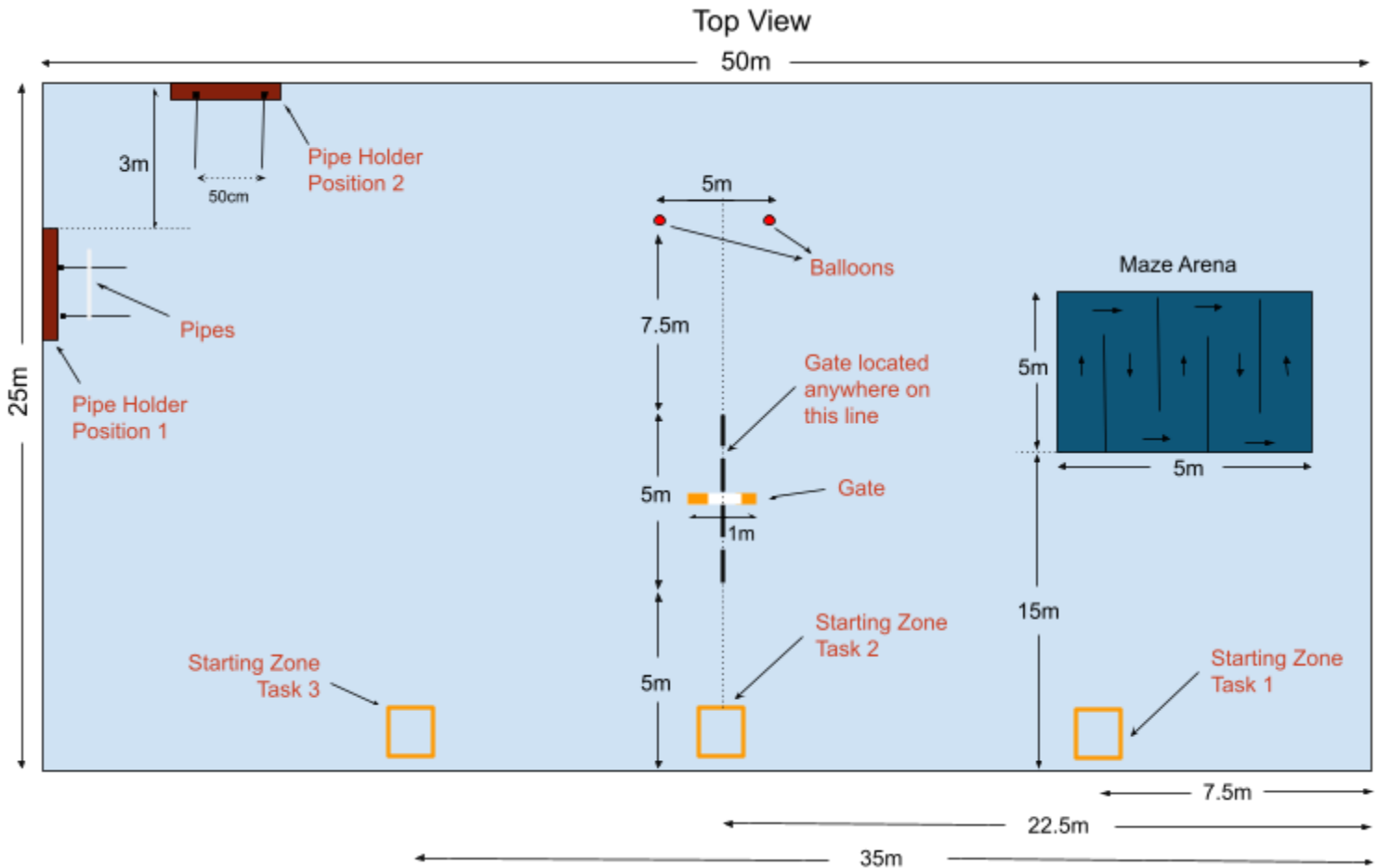
<https://amurov.co.in/>

Rule 2: Only the registered students of each team are eligible for the cash awards.

Rule 3 : Participants must be enrolled at their colleges/schools as a full-time student during winter and spring to be considered “students.”

Rule 4: One student cannot be a part of multiple teams.

12. The Arena



13. Competition Tasks

13.1. Task 1 : The Maze Walk

The aim of the task is to check the maneuvering of the vehicle.

The task is to move inside the maze arena on the surface of the pool, as shown in the fig.1.

The vehicle has to move along the maze from the starting point and move towards the exit while following the path marked. The path is 100 cm wide. The ROV may swim without touching the

Diagram illustrating a 2D channel flow problem. The channel has a total width of 5 m and a height of 5 m. The flow enters from the left ('enter') and exits to the right ('exit'). The channel contains two vertical obstacles: a thin plate on the left (3.5 m high) and a rectangular block in the center (1.0 m wide and 3.5 m high). The flow direction is indicated by arrows, showing a complex pattern around the obstacles.

13.1.1. Task Specification

- ### 13.1.2. Points.

- ### 13.1.3. Props specification



up of Poly Vinyl Chloride (PVC) Pipes on the surface without any walls beneath.

13.2. Task 2 : Vision and Control

The goal of the challenge is to find and capture a target amid two balloons at the pool's bottom, each with a different color.

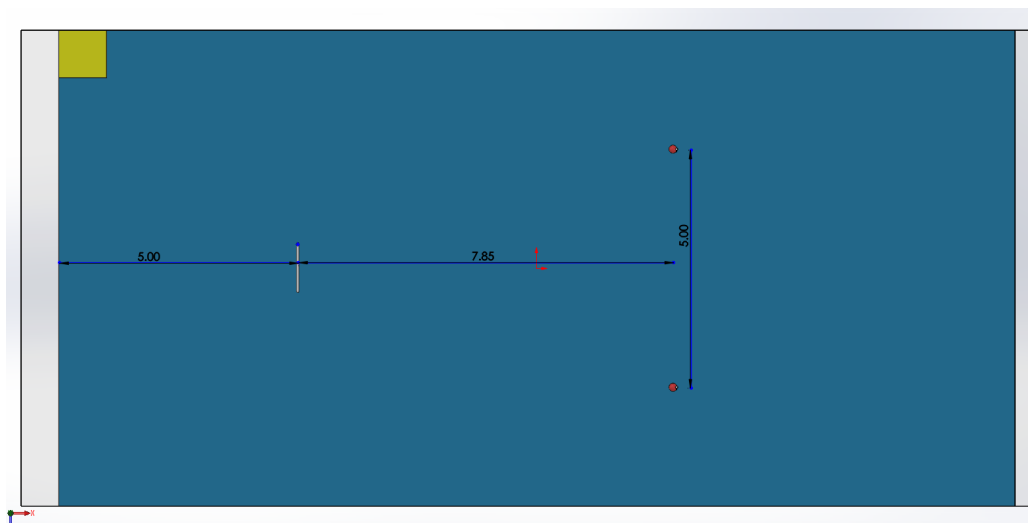


Fig. 2-i : Top View

A target zone is established by two balloons with two different colors on each of the balloons, namely pink and orange, and two flags placed on the top section of the balloons. Fig. 2 depicts the position of the balloons in relation to the arena.

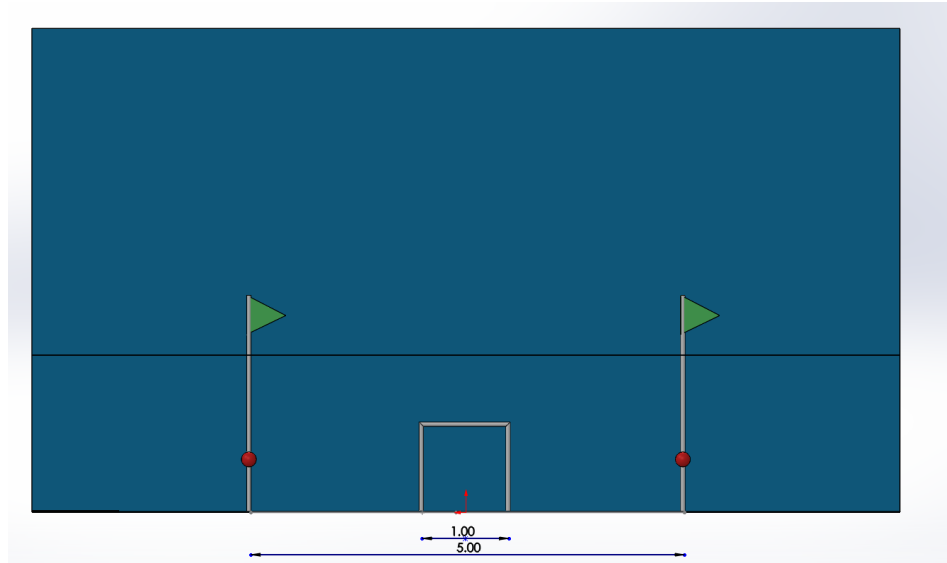


Fig 2-ii : Front View

In the arena, there are two balloons. They're submerged in the target zone. On the top of both balloons, will be two flags. Each team is given a specific color representing a specific balloon. The ROV must begin at the starting position and then pass through the underwater gate, which is located around 5 m to 10 m from the starting point and has an inverted U form of height 1 m. When the ROV uses vision to locate the corresponding balloons with the specified color of blue and orange, points will be granted.

If the ROV only wanders around the balloons with the prescribed color, it will receive some points; however, if the ROV touches the balloon with the respective/assigned color, it will receive additional points.

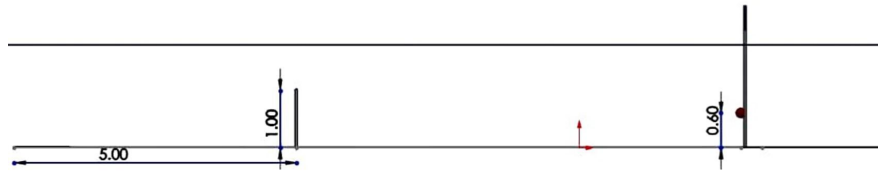


Fig 2-iii : Side View

13.2.1. Task Specifications

This task is time bound and will be evaluated accordingly for a total of 20 minutes for each team.

13.2.2. Points

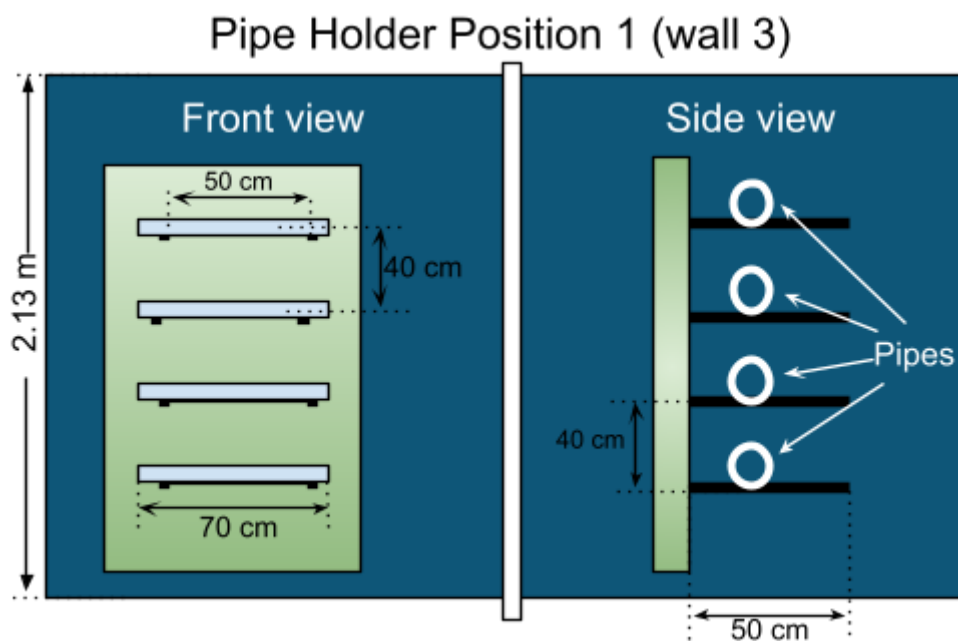
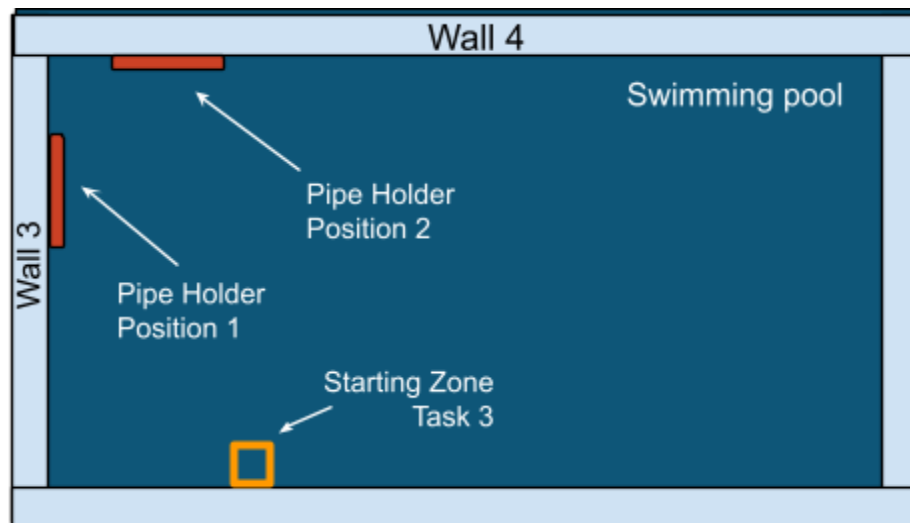
- The total points to be awarded to a team for this task is 100.
- 40 points will be given if the ROV passes through the gate.
- 60 points will be given when touching the specific balloon.
- 30 points will be given if the ROV wanders around the balloon with the prescribed shape.
- If the team touches the wrong balloon, then ZERO points will be marked for the team instead of 70.

13.2.3. Props Specifications

2 balloons with different colors will be tied to respective identical flags. The teams have to touch a specific balloon, whereas the other balloon should remain untouched.

13.3. Task 3 : Depth Control

The aim of the task is to reach the target pipe holder, then carry each pipe from their initial pipe holder position to the specified pipe holder location, beneath the water, to successfully complete the task.



The vehicle will start the task from the specified starting position, and has to reach “**Pipe Holder Position 1**” on wall 3 of the swimming pool; submerged under the water. The pipes are kept freely on the pipe holders. Consequently, the team has to dislocate all the pipes to the “**Pipe Holder Position 2**” on wall 4 of the swimming pool; submerged under the water, in order to complete the task.

13.3.1. Task specification

- This task is time bound and will be evaluated accordingly for a total of 20 minutes for each team.
- The starting zone of task 3 is subject to change.

13.3.2. Points

- The total points to be awarded to the team for this task is 100.
- On every successful lifting of each pipe, 10 points will be awarded.
- On successful placement of each pipe to the defined pipe holders location, 15 more points will be awarded.

13.3.3. Props specification

The PVC pipe will be used and kept on the wooden holders which are made to stick to the wall like a hanger. The diameter of the PVC pipe is 1.25 inches and each of it is 70 cm long . The space in between the holders will be 50 cm horizontally and 40 cm vertically. Pipe holders 1 and 2 on

wall 3 and 4 respectively are kept identical in terms of dimensions and design.

14. General Restriction

- Team members are not allowed inside the swimming pool at any point during the game.
- Team members may not disturb the water surface once the game starts.
- Members of other teams are not allowed in the game area.
- Team is not allowed to use ROV in the task which is not of the same weight as during entry.
- Nobody is allowed to wear any footwear near the pool area.
- The Judges may suspend the challenge if the weather turns unfavorable.
- The pool area must be evacuated in case of lightning.

15. Prizes

UG Category

- The first three winners will be awarded prizes, total cash pool of worth: Rs.50,000.
- Certificates will be awarded to all participants.
- Prize distribution ceremony will be held in A.M.U

School Category

- The following prizes will be awarded for the following positions:

- 1st - ₹1000
- 2nd - ₹700
- 3rd - ₹500
- All the winners will have a chance to visit the AMUROV challenge-UG category at the venue.

16. Disqualification

Teams may be disqualified if :

- Oil or lubrication leaks causing the pollution of the pool.
- Battery leak causing the pollution of the pool.
- The ROV damages or tries to damage the arena, facilities or equipment.
- The team performs any acts that are not in the spirit of fair play.
- The team fails to obey instructions or warnings issued by the Judges.
- The team who doesn't use their complete ROV for all tasks in the pool which is shown during the time of weighting.
- If the team does not abide by the general restrictions.

17. Others

- The legitimacy of any actions not provided in this rulebook will be subject to discretion of the Judges.
- The dimensions, weights, etc. of the field, facilities and equipment stated in this rulebook have a margin of error of $\pm 5\%$ unless otherwise stated. However the dimensions and weights of the ROVs as stated in the rule book are the maximum and cannot be deviated.

- The Judges may demand additional explanations on safety issues when the safety of a vehicle is deemed to be in question.