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ABES Engineering College

Vayudoot

Elevate the Game , Rule the Air!

2025

Organized By: Department of Mechanical Engineering and Orbits - Industrial Consulting Wing of ABES Engineering College.

Rulebook

18-19 April, 2025

ABES EC, Ghaziabad.

Organized By

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Vayudoot- 2025

Welcome to **Vayudoot**– the Uncrewed Aircraft System (UAS) Design, Build, and Fly Contest 2025. The system requirements are designed to align with real-world Uncrewed Aircraft System (UAS) needs, providing teams with valuable industrial exposure. The theme for this edition of Vayudoot is

"Disaster Management."

- **Phase – 1: Design Presentation & Flying competition**
- **Phase – 2: Business Proposal**

The teams must submit a design report of their UAS in Phase - 1, adhere to the contest design rules/ guidelines, and present it to the jury. The teams must complete the missions in the rulebook during the flying competition. The top 3 teams will be declared as the winners of this contest. Not only Universities/ Institutions but early-stage startups can also nominate any number of teams if they meet the team formation requirements listed in this document. Please read these rules carefully. Watch out for official announcements and updates concerning this contest and rule interpretations on the VAYUDOOT website.

Best of luck to you all!!

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NOTE: ** **Exemptions for startups**

OVERVIEW

The Indian government is poised to transform the country into a premier hub for Uncrewed Aircraft Systems (UAS) drones by 2030, as part of the ambitious Atmanirbhar Bharat Abhiyan initiative. This dynamic effort aims to accelerate the growth of India's UAS market, projected to soar to approximately $6.8 billion within the next five years. Uncrewed Aircraft Systems are making significant strides across a multitude of industries, including defence, construction, infrastructure, mining, telecommunications, geospatial mapping, agriculture, media and entertainment, law enforcement, and oil and gas. Their versatile applications span from surveillance and security to disaster management, land surveying, and progress monitoring through cutting-edge aerial photography and thermal imaging. As technological advancements accelerate and costs decline, the emergence of practical consumer applications for drones is becoming an exciting reality. These innovations include drone-assisted last-mile delivery services in the retail, healthcare, and logistics sectors. In this thriving landscape, ABES is proud to present the **Vayudoot** - UNCREWED AIRCRAFT SYSTEM (UAS), FLY CONTEST, affectionately known as **Vayudoot 2025**. This competition not only equips participants with essential skills in designing and building a UAS but also opens doors to potential grants for budding entrepreneurs seeking to launch their startups. The Vayudoot organising committee has introduced an exciting new stage dedicated to fostering an entrepreneurial mindset, titled "**DRONEXCEL**" to support startups. In

conclusion, Vayudoot 2025 empowers students to fully immerse themselves in the entire design and build cycle of a UAS that meets specific mission requirements, culminating in a thrilling flight demonstration during the competition.

1.1 Competition Procedure and Schedule

The competition is divided into two stages:

1. Design Presentation & Technical Inspection
2. Flying Missions

- **Design Presentation & Flying Missions**

PRESENTATION & MISSIONS	POINTS
System Design and Development Review	
• Design Report and Presentation	25
• Technical Inspection	30
Flying Missions	
• Obstacle Avoidance	40
• Payload Drop	40

- **Schedule Of the Events**

Description	Date
Commencement of Team Registration	03/03/2025
Early Bird Registration deadline	15/03/2025
Last Date for Team Registration	05/04/2025
Design report submission	14/04/2025
Day 1 – Flying phases and design presentation	18/04/2025
Day 2 – Business proposal and closing ceremony	19/04/2025

1.2 Registration

All teams must complete the registration process. The registration procedure includes:

1. Fill out the team details.

2. The Undertaking form (Appendix A) must be signed by the Head of the Institute.**

3. Upload the softcopy of the undertaking on the registration form and bring it at the time of reporting.**

1.3 Team Formation

1. The competition is open to students of Indian origin studying in educational institutions located in India.**

2. The team is to consist of students pursuing (full-time and non-sponsored) undergraduate programmes. Sponsored/External students are not eligible to participate in the Vayudoot 2025.**

3. The team should consist of a minimum of 4 members and a maximum of 6 members excluding mentors.

4. Each team should identify one member as team lead.

5. Any communication from the organisers will be sent to only the team lead and any query/clarification should also be raised only using the team lead's registered email ID. No response will be provided to the email addresses other than that of the registered email ID.

1.4 Registration Fees

A team can comprise a maximum of six students and one faculty advisor.

The registration fee for Vayudoot is:

1. Rs. 4,000/- (Four Thousand Only) per team - **Early Bird Offer**
2. Rs. 5,000/- (Five Thousand Only) per team

1.5 Disqualification from Contest

Teams registering for Vayudoot – UNCREWED AIRCRAFT SYSTEM (UAS) FLY CONTEST are required to submit a design report on the design of the UAS. Failure to submit the design report on or within the specified date will constitute a demerit point of your team from the contest. Your team will be notified the next day of the due date about non-submission, your team will be disqualified after two days of this notification and no refund will be given.

1.6 Violations of Rule Intent

The violations of the intent of a rule will be considered a violation of the rule itself. Questions about the intent or meaning of a rule may be addressed to the Vayudoot Committee.

1.7 Conditions and Penalties

Organizers retain the right to adjust points and penalties as detailed in the various event descriptions. This may be necessary to accurately reflect the design of specific events or to accommodate unique conditions associated with the contest.

1.8 Rules Compliance

All participants, including team members, faculty advisors, and university representatives, must comply with the rules set forth by the Vayudoot Contest Committee. By registering for the contest, participants agree to adhere to these rules and follow any instructions provided by the organizers, officials, and jury members.

1.9 UAS Design and Flight Requirement

The objective of this contest is to design, build and fly a multirotor UAV that can deliver cargo to a specified location along with an obstacle course. The teams shall design a drone that can carry a specified payload and deliver it to a target while avoiding obstacles and object capturing of the hotspot by manual operation

1.10 Expectations

1.10.1. **Design With No Professional's Involvement**

The drone must be designed by student members without direct involvement from faculty members or professionals. The students may use any literature or knowledge related to drone design, construction and information from professionals/ industry mentors or professors, as long as the information is given as a discussion of alternatives with their pros and cons and is acknowledged in the references in the design report. Professionals may not make design decisions, nor contribute to the drawings, the report, or the construction of the drones. **The Faculty Advisor must sign the Statement of Compliance given in Appendix A.****

1.10.2. Faculty Advisor

Each team is expected to have a Faculty Advisor from the registered university or institution. Non-faculty members are not allowed to be advisors. The Faculty Advisor will be considered as the official university representative for that team by contest organisers. Faculty Advisors may advise their teams on general engineering and engineering project management theory but should not be directly involved in the design of any part of the vehicle nor directly participate in the development of any documentation or presentation. They may review the design reports and provide suggestions and guide the team prior to the report submission and flying competition.**

2. DESIGN REQUIREMENTS

The design requirements of the drone are listed in Table 1 and the payload dimensions are 10 cm x 5 cm x 5 cm.

S.No.	Types	Description
1.	Aerial vehicle	Rotor craft (Micro Drone, Mass < 2kg) (As per Drone rules-2021, issued by the Ministry of Civil Aviation as per the Gazette of India CGDL-E-26082021-229221 or the latest version) https://www.civilaviation.gov.in/ministry-documents/rules
2.	Power Source	Battery operated only
3.	Communication	RF radiation mode only
4.	Category payload capacity	200 Grams
5.	Communication system range	At least 1 km

Table 1: Typical Specifications of Autonomous Navigation for an Aerial Vehicle (ANAV)

3. DESIGN REPORT & ORAL PRESENTATION

In phase – 1, the participant teams are required to submit a technical design report of their drone as per the design requirements & constraints given in the above Section. The teams are also required to give a presentation to a jury comprising industry and academic experts who will evaluate the designs.

3.1 Design Report & Presentation

Teams are required to submit a design report and prepare a detailed presentation (Microsoft PowerPoint Format) and present it to the jury. The design report and presentation must have the following contents:

a) Overall Design

I. High-level physical view: Physical elements and their arrangements.

b) Detailed Design

I. Detailed weight breakdown & C.G. of final UAS Design.

II. Estimation of Thrust required.

III. UAS Sizing (Wheelbase, Rotor Arm, Hub, Propeller Clearance, Landing gear)

IV. UAS Performance (Power required estimation, Power System (battery) Selection, Endurance Estimation)

V. C.G. Estimation & Stability Analysis

VI. Final CAD model (2D Drafting Front view, Top view and Side View, 3D Model)

VII. Complete list of components used

3.2 TECHNICAL INSPECTION

All UAS will undergo a technical inspection by a designated UAS inspector before being allowed to make any flight demonstration. Technical and safety inspection of all UAS will be conducted as per the general safety guidelines followed in the industry and all decisions of the UAS inspector are final.

Technical and safety inspection is the process of checking the UAS for:

1. Compliance with all specified UAS design requirements.

2. Overall safety and airworthiness.

All UAS must pass the Technical and Safety Inspection in order to compete. It is strongly recommended to have a self-inspection checklist at the contest.

During the Technical Inspection, the following will be checked,

a) UAV Dimensions conformance to 2D Drawings submitted during stage - 1

b) Use of the same components selected in stage - 1

- Propulsion - Motor, Electronic Speed Controller & Propeller, Power System – Battery, Control & Communication System - Flight Controller, Radio Transmitter & Receiver)

c) Take-off weight same as submitted in the design report

d) Structural Integrity

- All the components are secured well, proper wiring (i.e., no wires hanging, use of appropriate gauge wires and connectors), secure fasteners - use of locknuts or thread locker for fasteners, no structural components are loose or shaking, propeller attachment, payload attachment.

e) Failsafe Checks:

- The UAV will be inspected if the Safety Features are enabled or not
- **Battery Failsafe**: The UAV should RTL in case of Low Battery.
- **Geo-Fence**: The UAV Should not breach the geo-fence during the Manual mode. The UAV should Return to Launch when breached. The Geo-fence coordinates will be provided at least a day before the flight.
- **Radio-Failsafe**: The UAV Should RTL when the datalink is Lost.

f) Other Checks

- Proper control response (motor rpm) to Radio controller inputs, Motor/ Propeller Rotating direction, Radio Range Check, Motor Arming and Disarming check.

g) Deviation from the above if any, should be normalized through the prescribed change request process defined in section 3.2.2.

A detailed technical inspection will be performed for the first flight and a visual inspection for the subsequent incident-free flight. If the UAS is damaged during a mission or trial, a detailed inspection will be repeated. It is recommended to have strategically selected spare structures and components in case of any unexpected incident during the transit/ competition.

3.2.1. UAS Conformance to 2D Drawing

During Technical Inspection, the UAS will be inspected and measured for conformance to the 2D drawing presented in the Design Report.

a) At a minimum, drone arm length, landing gear height and drone height dimensions will be measured and compared to the 2D drawing.

b) All teams must have a hard copy of their design report with them during technical inspection.

c) UAS's actual empty CG will be compared to the empty CG presented in the design report's 2D drawing.

3.2.2. Deviations from 2D Drawing

Any deviation in the construction of the UAS from the submitted 2D drawing since the submission of the Design Report must be reported in writing.

a) Each design change must be documented separately using the Modification Change Request (CR) in APPENDIX B.

b) Only one design change may be submitted per CR form.

c) The jury will assess penalty points for design changes.

3.2.3. Inspection of Spare UAS Components

- All spare UAS components (structural parts, motors, propeller, batteries etc.) must be presented for inspection at the same time as the UAS inspection.

3.2.4. Inspection Requirements Throughout the Contest

- All UAS must meet all Technical and Safety Inspection requirements throughout the contest.
- Any official may request that a UAS be re-inspected if a general or safety requirement problem is seen on a UAS at any time during the event.
- This includes any unintended errors or omissions made by officials during inspection.

3.2.5. Technical and Safety Inspection Penalties

- Points are allotted for the Technical and Safety Inspection.
- Teams may lose points if errors and problems are encountered during the inspection process. Any penalties assessed during

Technical Inspection will be applied to the overall contest score. Refer to section 5.3 for the detailed evaluation criteria.

4. FLYING COMPETITION

- Both missions will be manual Operation
  - ❖ Flight Mission 1 – Obstacle Avoidance
  - ❖ Flight Mission 2 – Hotspot Capturing and Payload Drop
- Scoring will be awarded individually for both the round.
- If the UAS is damaged beyond repair or if it is deemed not airworthy by the UAS inspectors, then the team shall forfeit their next attempts.
- The cruise altitude for all the rounds in the competition is set to 15m. Any mention of cruise altitude in Section 4.2 and 4.3 refers to this value unless specifically mentioned otherwise.
  - **Cruise altitude → 15 meters**
  - **Payload drop altitude → 5 meters**

4.1 Ground Rules

The following are the important rules which must be followed throughout the competition because of safety and keep up the spirit of competition. If any team is found not following these rules, Vayudoot COMMITTEE reserves the right to disqualify the team.

- The team members as representatives of the university or startups and are required to maintain etiquette and decorum to uphold the dignity of their college and organisation. If the team has any concerns, only the team leader is to approach the jury politely without hampering the ongoing event.
- All queries/ concerns on the field must be directed to the grievance committee representative available onsite and teams should not disturb the jury to perform their functioning.

- Geo-fence coordinates will be given to the teams. Geo-fencing must be enabled and the team must cooperate with the marshals to verify it at any time.
- Expect for the missions, the teams must not fly in their system anywhere on the campus during the competition.
- The teams must cooperate with Vayudoot representatives for inspection as per the requirements defined in section 3.2.
- Each team will be provided with a flight time of 10 minutes to complete the mission. The team must ensure that the UAS lands within this time.
- The teams are requested to adhere to the schedule of the program. Teams will forfeit their chance to fly if they do not report to the ground within 5 minutes of being called for their respective mission flight.
- If a UAS is damaged after an unsuccessful flight round, the teams shall carry out necessary repairs, if possible, without making any modifications that deviate from the submitted design before the flight call for their next attempt. However, the UAS must go through the inspection once again and be cleared as airworthy before their next attempt or else the team shall be forfeited by default.

NOTE - *ABES encourages all participants to prioritize safety during the event. While the team holds full responsibility for ensuring a safe and secure experience, ABES will not be liable for any unforeseen incidents.*

4.2 Flight Mission 1 – Obstacle Avoidance

Leg 1: Take-off & Obstacle Navigation

- The drone must take off from the designated area and navigate through a series of geometrical hurdles (rectangles, circles) while maintaining cruise altitude.

- Between hurdles, the drone must touch down on pole plates of varying heights before proceeding.

Leg 2: Circular Cage Navigation

- After clearing the hurdles and touchdown points, the drone must enter and navigate through a circular wired open cage without touching the wires while maintaining cruise altitude.
- Successful navigation through the cage allows the drone to proceed to the next phase.

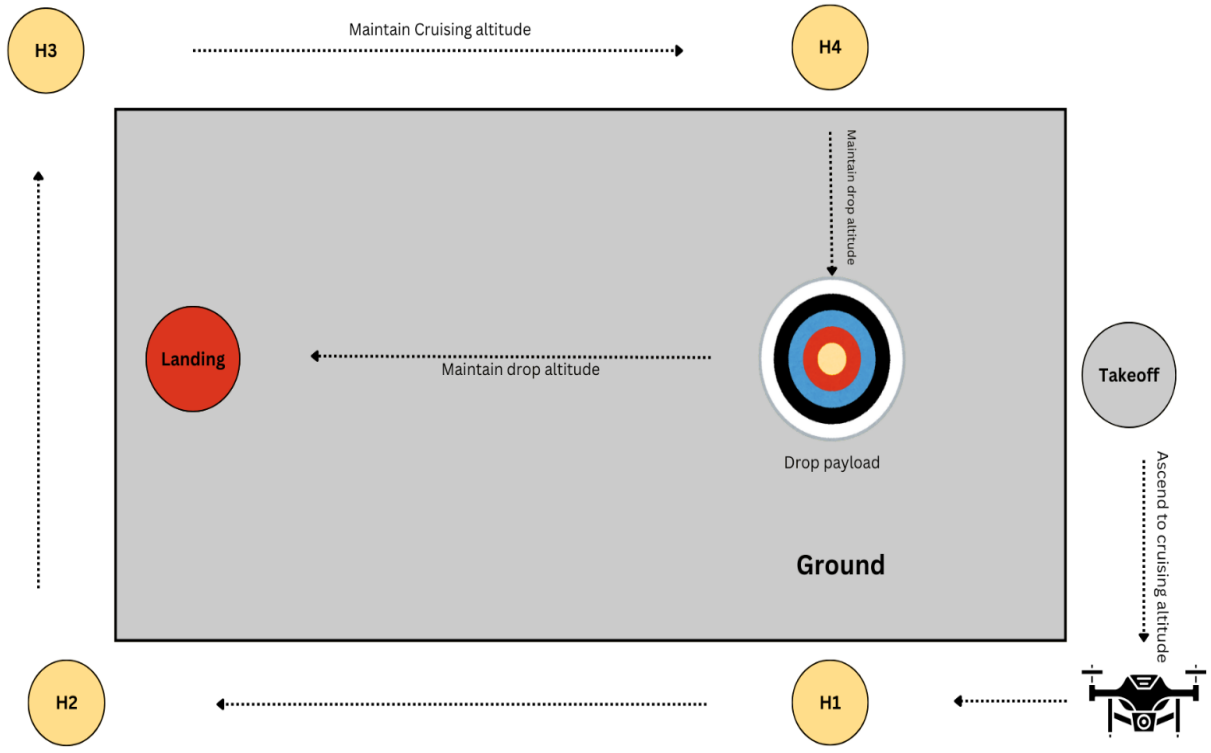
Leg 3: Final Pole Shutdown & Return

- The drone must reach the final pole at a specific height and perform a **complete shutdown** before restarting.
- Using the final pole as a reference, the drone must return to the take-off zone and land safely while maintaining cruise altitude.

Mission Completion & Scoring

- Pilots must manually maintain mission altitudes as per milestones without the aid of autopilot programs.
- Each team will be provided a flight time of 10 minutes to complete the mission. The time starts when the throttle input is increased for the take-off.
- The mission is complete when the drone successfully returns to the take-off point and lands safely on the ground after following all required checkpoints and manoeuvres.
- Scoring will be based on the successful execution of each phase, including hurdle navigation, touchdowns, cage passage, shutdown procedure, and landing.
- While Figure 1 depicts the mission profile, actual conditions on the field may vary slightly.

Figure 1 – Mission 1



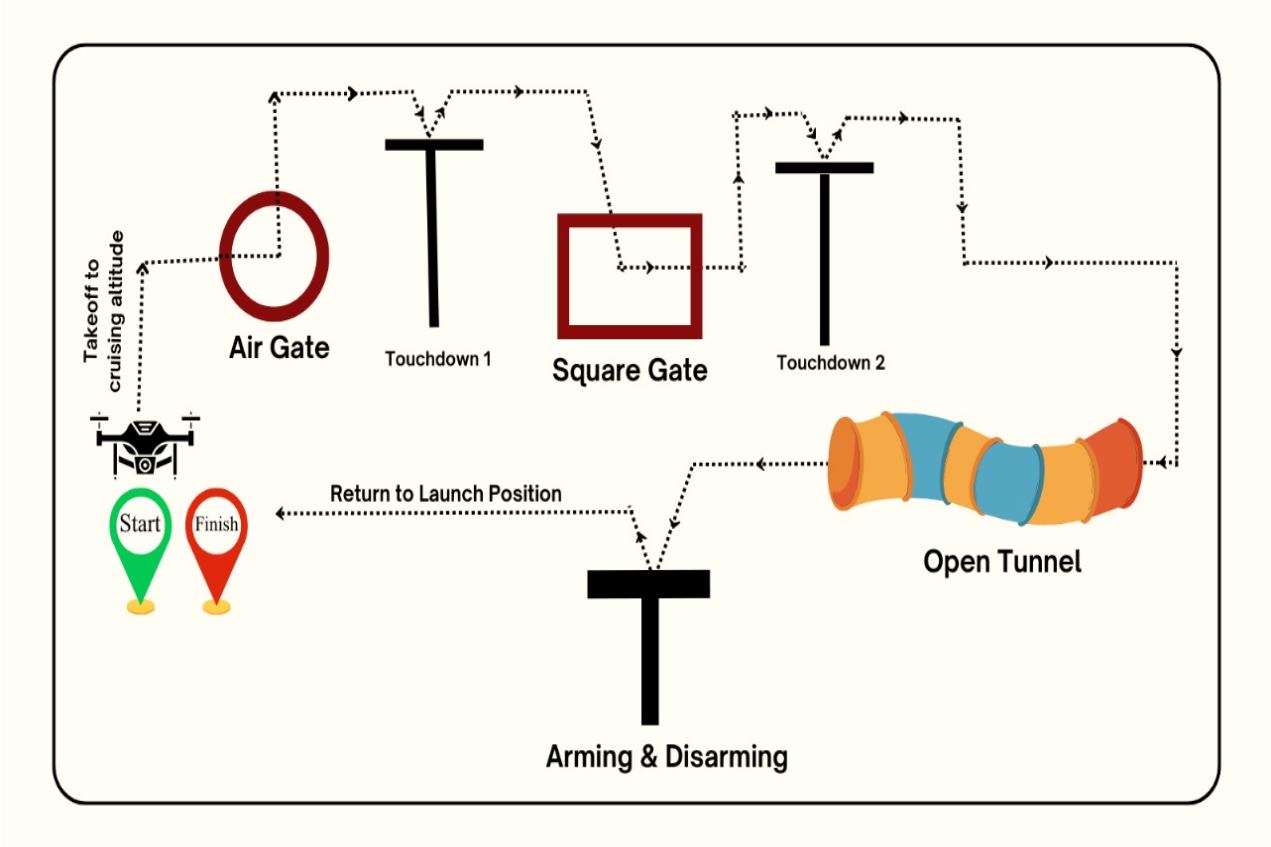
4.3 Flight Mission 2 – Hotspot Capturing and Payload Drop

In this mission, the UAS is expected to take off from the designated area along with the payload, climb to the cruise altitude and fly along the specified path capturing a hotspot. Clear the obstacle course, find the payload drop area and successfully deliver the payload.

1. Take off, reach cruise altitude, and fly following the specified path with obstacles.
2. The pilot should navigate the drone through obstacles of varying difficulties placed on the ground.
3. After successfully navigating the obstacle course and capturing hotspots, a pilot may proceed to identify the target for payload drop.
4. Once the target is identified, a pilot needs to descend to the payload drop altitude and deliver the payload at the centre of the target.
5. After dropping the payload, the pilot must bring the drone back to the landing point at cruise altitude and land safely thus concluding the mission.
6. Scoring will be provided for a successful flight mission. A flight is considered successful only if the drone takes off, completes the obstacle navigation course, captures hotspots, drops the payload, returns to the landing point, and lands safely on the ground. Refer to Section 5 for scoring information.
7. Scoring for the payload drop will be based on the distance at which the payload is dropped from the centre on the target area i.e., the closer the payload is to the target centre, the higher the score.
8. Each team will be provided a flight time of 10 minutes to complete the mission. The time starts when the throttle input is increased for the take-off.

9. While Figure 2 depicts the mission profile, actual conditions on the field may vary slightly.

Figure 2 – Mission 2



DRONEXCEL

Event Overview

During this stage, teams will be provided with a platform to present a business plan developed around their drone, showcasing its feasibility, market potential, and financial viability. Key stakeholders, including senior business experts and investors, will gather to assess the plan's feasibility, market potential, and technological advancements. Through interactive discussions, participants have to refine their proposals to align with funding requirements, bridging innovation with practical implementation. The evaluation criteria are not defined as the winning team will be decided by the Jury, but the recommended topics to cover could be:

- **Product-Market Fit**
  - Addresses a significant problem with a viable solution.
  - Meets customer needs effectively.
  - Validated through customer feedback and demand analysis.
- **Market Size**
  - Defines Total Addressable Market (TAM), Serviceable Available Market (SAM), and Serviceable Obtainable Market (SOM).
  - Highlights growth potential and scalability.
  - Provides market trends and demand forecasts.
- **Market Analysis**
  - Identifies industry trends and insights.
  - Includes a detailed competitor analysis (key players, differentiators, market gaps).
  - Performs SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis.

- **Team Strategy**

➢ Outlines roles and expertise of the founding team.
➢ Defines business execution plan and key responsibilities.
➢ Lists partnerships and collaborations.

- **Go-To-Market (GTM) Strategy**

➢ Specifies customer acquisition strategy and sales channels.
➢ Details marketing approach and branding tactics.
➢ Provides a roadmap for product/service launch.

- **Financial Planning**

➢ Presents revenue model and monetization strategies.
➢ Breaks down cost structure and operational expenses.
➢ Highlights funding requirements and investment potential.
➢ Includes financial projections (profit & loss, break-even analysis, ROI).

- **Format & Rules**

➢ Each team has 10-12 minutes to present their startup idea.
➢ A 5-minute Q&A session with judges follows each pitch.
➢ Presentation slides must cover all evaluation parameters.
➢ Judges will score based on feasibility, innovation, and business potential.

The aforementioned points are suggestive only, the teams are free to decide what points to cover and present.

NOTE – Scores of this stage will not be included in the overall contest score.

5. EVALUATION CRITERIA

5.1. Design Report and Presentation

S.No.	Parameter	Max Score
1.	**Technical Content**	**25**
1.1	Overall Design	4
1.2	Detailed Weight Breakdown & C.G.	2
1.3	Thrust Required Estimation	1
1.4	Aircraft Performance (Power required estimation, Power System (battery) Selection, Endurance Estimation)	3
1.5	Aircraft Sizing (Rotor Arm, Hub, Wheelbase, Propeller Clearance, Landing gear)	2
1.6	List of Components	2
2.	**Computational Analysis**	
2.1	Final CAD model (2D Drafting front view, Top view and Side view, 3D Model)	4
2.2	C.G. Estimation & Structural Analysis	2
3	**Presentation**	5

5.2. Technical Inspection

S.No.	Parameter	Max Score
2	**Technical Inspection**	**30**
2.1	Aircraft Dimensions Conformance to 2D Drawings, Submitted in design report	2
2.2	Use of the Same Components Selected in the Report	

	• Propulsion – Motor, ESC & Propeller	1
	• Power System – Battery	1
	• Control and Communication System – Flight controller, Radio Transmitter and Receiver	2
2.3	Take-off Weight Same as submitted in the design report	
	• Weight difference < 40g	5
	• Weight difference > 40g & < 150g	3
	• Weight difference > 150g – No points	0
2.4	Structural Integrity	
	• All the components are secured well	1
	• Proper wiring (i.e., no wires hanging, use of appropriate gauge wires and connectors)	2
	• Secure fasteners – use of locknuts or thread locker for fasteners	1
	• No structural components are loose or shaking	1
	• Payload attachment	2
2.5	Other Checks	
	• Proper control response (motor rpm) to Radio controller inputs	2
	• Radio Range Check	1
	• RTL for low battery	2
	• RTL for datalink lost	1
	• RTL for geo-fence breach	2
	• Geo-Fence inputs	1
2.6	Aesthetics	3

5.3. Flight Mission – 1

S.No	Parameter	Max Score
	Mission 1	**40**
3.1	Take off & Maintain Mission altitude	6
3.2	Obstacle Avoidance	10
3.3	Landing, Complete Shutdown & Communication re-establishment at the pole	10
3.4	Return to Take-off point and Land	4
3.5	Within time completion	10

5.4. Flight Mission – 2

S.No.	Parameter	Max Score
	Mission 2	**40**
4.1	Take off & Maintain Mission altitude	6
4.2	Avoid obstacles and capture all hotspot	10
4.3	Target Identification	4
4.4	Payload Drop at Target Point	6
4.5	Successfully landing at a designated position	4
4.6	Within Time Completion	10

APPENDIX A

STATEMENT OF COMPLIANCE

Certification of Approval

Team Name: _____

University/Institute: _____

Faculty Advisor: _____

Faculty Advisor's Email/Contact: _____

Statement of Compliance

As Faculty Advisor, I certify that registered team members are enrolled in bachelor's degree programs. This team has designed the drone for Vayudoot 2025 without direct assistance from professional engineers, R/C model experts, pilots, or related professionals

_____ _____

Signature Date

(Head of Department)

Team Captain Information:

Team Captain's Name:

Team Captain's E-mail:

Team Captain's Phone:

Note: A copy of this statement needs to be included in your Design Report as page 2

APPENDIX B

Design Change Request Form

Change Request
Team Name:
Institute:
Date:
Change Requester:
Change Requests information: (Fill in appropriate information)
Change Description:
Detail of Change:
Impact on previous Design:
What are the consequences if the proposed change(s) is not implemented? Explain

I have reviewed the information contained in this change request form and agree

Signature of Captain

Signature of Faculty Advisor