

# INTERNATIONAL AEROSPACE OLYMPIAD 2025



## SYLLABUS - GRADE 10TH - 12TH

### 1. Advanced Fundamentals of Aerospace

#### 1.1 Aerospace Disciplines

- Aerospace, aeronautics, and astronautics: Definitions, differences, and applications.
- Subfields of aerospace: Propulsion, avionics, aerodynamics, and materials science.

#### 1.2 Forces and Principles of Flight

- Lift, thrust, drag, and gravity: Advanced principles and mathematical relationships.
- Bernoulli's principle and the Coanda effect.

#### 1.3 Aerodynamics and Fluid Mechanics

- Flow patterns around airfoils: Laminar vs. turbulent flow.
- The impact of drag and methods of drag reduction.

### 2. Aircraft and Their Materials

#### 2.1 Materials in Aircraft Manufacturing

- Types of materials: Aluminum alloys, composites, titanium, and carbon fiber.
- Properties required for aerospace materials: Strength, weight, durability, and heat resistance.
- Future trends: Use of nanomaterials and 3D-printed components.

#### 2.2 Types of Aircraft

- Commercial jets, military aircraft, UAVs (drones), and experimental aircraft.
- Supersonic and hypersonic aircraft: Concorde and the future of high-speed travel.

### 3. History and Evolution of Aerospace

#### 3.1 Milestones in Aviation

- Early flight attempts to modern aviation technology.

#### 3.2 Space Exploration Timeline

- Key achievements: Sputnik, Apollo 11, Mars Rovers, and the James Webb Space Telescope.
- Evolution of reusable rocket technology (SpaceX, Blue Origin).

#### 3.3 Indian Contributions to Aerospace

- ISRO's milestones: From Aryabhata to Chandrayaan and Mangalyaan.
- Contributions of pioneers like Vikram Sarabhai and APJ Abdul Kalam.

### 4. Space Exploration and Astronautics

#### 4.1 Rocket Science and Propulsion

- Multi-stage rockets: Function and advantages.
- Basics of rocket propulsion: Chemical, electric, and ion propulsion systems.

#### 4.2 The International Space Station (ISS)

- Design and structure of the ISS.
- Role of international collaboration in the ISS.

#### 4.3 Spacecraft and Satellites

- Types of spacecraft: Crew modules, landers, rovers, and space probes.
- Orbits and their uses: Geostationary, polar, and LEO.

## 5. Atmosphere and Space Environment

### 5.1 Layers of the Atmosphere

- Troposphere to exosphere: Detailed study of characteristics and effects on flight.

### 5.2 Space Weather and Hazards

- Solar flares, cosmic radiation, and their impact on spacecraft and satellites.
- Importance of radiation shielding and thermal insulation in space missions.

## 6. Future of Aerospace and Space Exploration

### 6.1 Upcoming ISRO Missions

- Gaganyaan: India's first crewed space mission.
- Chandrayaan-4 and Aditya-L1: Advancing lunar and solar exploration.
- Mission to Venus and beyond: ISRO's long-term vision.

### 6.2 NASA's Upcoming Missions

- Artemis program: Returning humans to the Moon.
- Mars Sample Return Mission and Europa Clipper.
- Plans for interstellar exploration.

### 6.3 Innovations in Aerospace

- Space tourism: Companies like SpaceX, Blue Origin, and Virgin Galactic.
- Colonization of Mars: Challenges and progress.
- Advancements in AI and robotics for aerospace applications.

