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# ISRO Mock Interview Questions Compilation

Transcribed from Student Copies  
*Centre for Career Guidance and Placements, IIST*

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1. What are the main components of an aircraft?
2. What is the velocity required for LEO (Low Earth Orbit)?
3. Name some series of sounding rockets made by ISRO.
4. What are the landing differences between the lunar and Martian surfaces? Which one is better?
5. What do the digits in NACA0012 signify?
6. For stability in a rocket, what is the stability criteria?
7. How many stages does the GSLV Mk III have?
8. What is the formula for  $\Delta V$  (for staged rockets)?
9. How do pressure and density change with height in the atmosphere?
10. Is stability required for fighter aircraft?
11. What does the fin do on aircraft?

1. What is the difference between trapezoidal wings and delta wings?
2. Which type of wings are used for supersonic flows and subsonic flows?
3. Draw the cycle diagrams for different engines.
4. Explain drag estimation.
5. Questions on specific heat and basic thermodynamics.
6. Explain stress-strain curves for different materials.
7. Compare a solid motor engine vs. a liquid propellant engine vs. a semi-cryogenic engine.
8. What are the different types of drag?

**Areas of Interest****Subjects of Interest:**

- Aerodynamics
- Structures

**Interested Work Areas:**

- Aerodynamic design and analysis of launch vehicles
- Structural analysis of aerospace components

**Interview Questions**

1. Tell the configuration of GSLV and PSLV and their differences.
2. Tell about the nose cone shapes of launch vehicles (e.g., conical, ogive). Draw them and the airflow around them. Which produces less heat? Explain normal and oblique shocks, attached and detached shocks, and the Prandtl-Meyer formula. What is the relation between heat production and nose cone radius?
3. Why do we use fins? Explain stability.
4. What are the design requirements while designing a launch vehicle? Draw the block diagram of all the domains/fields required while designing an LV (structure, aerodynamics, propulsion, etc.).
5. What optimization techniques are required while designing? What is multidisciplinary optimization?
6. Why do we use composites? What is the payload fraction? What is the normal range of payload fraction in present-day launch vehicles?
7. What parts of a launch vehicle are made up of composites?
8. What are the subsonic, transonic, supersonic, and hypersonic ranges? Draw the  $C_D$  vs.  $C_L$  curve of an aircraft, and explain the graph. What is  $\kappa$  in the formula  $C_D = C_{D_0} + \kappa C_L^2$ ? What is the hypersonic Mach number?
9. Tell about solid, liquid, and cryogenic LVs. Why is it called a solid motor and a liquid engine? What is specific impulse? Which will have a higher specific impulse: a solid motor or a liquid engine? Which is better performance-wise? Which can be controlled better?
10. Based on the interested area of work you have mentioned, what courses have you taken?
11. Tell about compression and tensile structures.
12. What are the various modes of heat transfer? What is the difference between conduction, convection, and radiation? Difference between forced and free convection?
13. What are pressure vessels? What are internal and external pressure vessels? Is the motor casing inside a rocket an internal or external pressure vessel? Give an example of an external pressure vessel. What is the formula for stress of a cylindrical pressure vessel? What about a spherical one? Why are the ends of internal pressure vessels dome-shaped and not straight?
14. Imagine you are given the internal pressure value of a pressure vessel. Detail the engineering approach for designing a suitable pressure vessel.

15. What are shells? What are stiffened structures? What is buckling? If a compressive load is applied on a shell, what will be the longitudinal and lateral displacements of it?
16. A threaded bolt undergoes preload testing. What is the reason? What is preloading? Draw the load vs. displacement graph and explain.
17. Questions about payload fairings, heat shields, and a few more terms related to launch vehicle parts.

1. Explain the variation of Mach number, pressure (static, stagnation), and velocity in a C-D nozzle.
2. Explain the variation of heat and temperature in a C-D nozzle.
3. Plot specific heat capacity vs. temperature.
4. Discuss rarefied flows, ionization, and dissociation in HTGD (High-Temperature Gas Dynamics).
5. What are thermal ablatives?
6. What is the hammering effect?
7. What are the different types of nozzles?
8. What is Mach number?
9. What is thermal diffusivity?
10. What do you mean by insulation?
11. What types of thermal control strategies are used in rockets?
12. What is an accumulator?
13. In pipe flow, what happens when you suddenly stop the flow? What happens to the pressure energy and strain energy?
14. Have you heard of pogo oscillation?
15. What is plasma?
16. Have you heard of the Hugoniot equation?
17. Describe the LVM vehicle nozzle. Why is it shaped like that?

1. What is a honeycomb structure?
2. Compare CFRP vs. GFRP. What are the advantages of CFRP?
3. What are sandwich components?
4. Draw the stress-strain curve.
5. Discuss pressure vessels (cylinder and sphere). What are the formulas for hoop stress and longitudinal stress?
6. Draw the stress-strain curve for composites.
7. Draw a wing and airfoil diagram.
8. What is Young's modulus for CFRP, Steel, and Aluminum?
9. What types of materials are used in a launch vehicle?
10. Write the equations for conduction, convection, and radiation.



1. What is laminar flow? What are different flows other than laminar?
2. How does the Mach number vary along a nozzle? What about velocity, pressure, and temperature?
3. What is the ideal gas equation?
4. How does surface heat flux vary across a nozzle and why?
5. What was your internship topic?
6. What is a turbulence model?
7. What is the HLLC Scheme? What does 'C' stand for in HLLC?
8. What is the difference between a shock and a contact discontinuity?
9. What is a vector flux splitting scheme?
10. What is acoustic speed?
11. Which software did you use?
12. What material should be used at the throat of a nozzle?
13. What are the different types of components?
14. What are overexpansion and under-expansion?
15. What is the ideal temperature in a nozzle?
16. What are the different types of stages in a rocket?
17. Do you have an idea about ISRO rocket configurations? What is the difference between PSLV and GSLV?
18. How much payload can GSLV carry?
19. What is the difference between solid motors and liquid engines? Which has a high payload fraction?
20. What are the payload fraction numbers for solid, liquid, and cryo stages?
21. Are you studying rocket propulsion? What topics are being taught now?
22. What is a non-air-breathing propulsion vehicle? What about air-breathing propulsion? Is a ship air-breathing or non-air-breathing?

### Suggestions & Feedback

**Overall Suggestion:** Read about other subjects that are not related to your internship or interested topics. The panel has professors from all types of subjects, so be prepared to answer basic concepts.

1. Kepler's Laws.
2. Laws of Thermodynamics (specifically the 2nd law).
3. Specific Fuel Consumption (SFC) for Turbojet and Turboprop engines.
4. Newton's Laws.
5. How to reduce drag on an aircraft.
6. Subsonic and Supersonic Airfoils.
7. Different schemes in CFD.
8. Ramjet and Scramjet engines.
9. Flashback of glow.

1. Introduce Yourself.

2. **Rocket Thermodynamics & Heat Transfer:**

- Coefficient of thrust.
- Nozzle thrust equation.
- Thrust vs. altitude equation.
- Types of nozzles.
- Nozzle expansion vs. height.
- Insulation materials for rockets and satellites.

3. **Structures:**

- Stress-Strain Curve.
- Normal vs. Shear strain.

**Areas of Interest****Topic of Interest:** Fluid Mechanics, Aerodynamics**Interview Questions**

1. What are the control systems used in a Launch Vehicle?
2. What are the parameters used in designing a launch vehicle?
3. What is neutral point stability?
4. What is the center of pressure?
5. What is static equilibrium and dynamic equilibrium?
6. What are fins in launch vehicles? How do you design fins? How are forces and moments analyzed in fins?
7. What are high temperature effects and where do they occur?
8. Write the internal energy equation in high temperature gas.
9. Draw nozzle graphs: pressure vs. distance, temperature vs. distance, heat flux vs. distance.
10. What is CFD?
11. How do you model a flow in an engine? What are the parameters you solve for in the fluid?
12. What is Boundary Layer Theory?
13. Draw the contours of the flow over an airfoil in both attached flow and separated flow.
14. Questions regarding orbits: Geostationary and polar orbits.
15. Where are steel and aluminum used in a launch vehicle?
16. What are the technological advancements in the GSLV?
17. Questions regarding propellants.

## Propulsion

1. Draw a nozzle.
2. What material is used in a nozzle?
3. How does ignition work? What igniters are used?
4. For a solid propellant, what binder is used?
5. Why are cryo-propellants the best? (Relate specific impulse to molecular weight)
6. What cooling methods are used in rockets?
7. Write the continuity, mass conservation, energy, and momentum equations.
8. Is Green Propulsion used by any company?
9. What are the harmful products of propulsion?
10. How is thrust generated?
11. What is the heat of formation?
12. What are hypergolic fuels?
13. What is Gibbs Free Energy? Enthalpy?

## Structures

1. What are the differences between a bolt and a screw?
2. What loads act on a satellite? What are the types of loads and their directions?
3. What is resonance?
4. What materials are used in satellites? What are their yield strength and Poisson's ratio?

## Aerodynamics

1. What is aerodynamics?
2. Draw an airfoil and explain its nomenclature.
3. What is camber? Show it on a diagram.
4. Explain NACA Nomenclature.
5. What is the role of ailerons, flaps, and elevators?
6. Explain neutral stability and static margin.
7. State the basic continuity equation.
8. How is velocity measured? (Pitot-static tube equation)
9. What type of equations are the RANS equations (elliptic, hyperbolic, parabolic)?
10. Are the RANS equations open or closed?

1. Why is a nozzle shaped the way it is? Why does it have a paraboloid shape? (Derive equations)
2. Write all governing equations for compressible and incompressible flow.
3. Draw the SFD and BMD for a cantilever beam.
4. What is the difference between a shock and a wave?
5. What are the ways to solve the governing equations of fluid dynamics?
6. If a hole is put in the divergent section of a nozzle, what happens to the pressure?
7. Explain the thrust generated by a nozzle. Where does it act? On the whole nozzle or outside as well?
8. Give a description of the PSLV.
9. What is discretization in CFD?
10. Name some CFD methods, e.g., grids, vortex panel methods, method of characteristics.
11. Explain nut/bolt formulas and preloading.

1. Introduce Yourself.
2. Questions related to propulsion: types of propellants, which fuel gives more velocity, what materials are used.
3. Read the fundamentals and history related to rockets. (They suggested the book written by B. N. Suresh)
4. How do you discretize an equation? (CFD)
5. What is the CFL number?
6. What is the polar moment of inertia?
7. About Geostationary orbit.
8. What is natural frequency (acoustics)?
9. What is resonance?
10. When can we launch a satellite for Geostationary and Polar orbits?
11. Draw the supersonic nozzle of a rocket. Is it subsonic at the throat?
12. Read books by J.D. Anderson for aerodynamics, compressible flow, and CFD.
13. Remember some numbers, like the pressure ratio at the nozzle.
14. Kepler's Law.
15. Purpose of Chandrayaan-3. (National Space Day Celebration)
16. Who was the father of modern rocket science?

**Areas of Interest****Topics of Interest:** Heat transfer, Orbital mechanics, Strength of materials**Interview Questions**

1. What was the recent launch on May 18? Was it successful?
2. Explain char-ablation. What material is used?
3. What are the different types of heat transfer in launch vehicles?
4. Describe heat transfer in a combustion chamber.
5. How do you find the convective heat transfer coefficient?
6. What is the unit of thermal diffusivity? What is its definition?
7. What are the properties of an insulation material?
8. What is bending moment and shear force?
9. Draw the shear stress distribution across the depth of a beam.
10. What are the different parts of an aircraft and their functions?
11. What is an airfoil?
12. Draw the pressure distribution for an airfoil.
13. What is turbulence and flow separation?
14. What is a streamline? Stream function?
15. What is the Prandtl-Glauert equation?
16. Explain Potential Flow Theory.
17. What are the Mach number ranges for compressible flow (subsonic, transonic, etc.)?
18. How do you find lift in all these regions?
19. What is the hypersonic region?
20. What is the governing equation for lift generation?



1. Topics: Thermodynamics, Strength of Materials, Acoustics.
2. Draw BMD and SFD. Bending on a beam without shear stress? What is the point of contraflexure?
3. PSLV and GSLV payload capacity.
4. Propulsion: Nozzle pressure diagram, Mach number diagram. What is an over-expanded and subsonic nozzle? Draw the pressure diagram if  $M = 1$  is in the divergent section.
5. Nomenclature of an airfoil and pressure over it.
6. Acoustics on Rockets. At launch, how is acoustics used? What is Acoustics?
7. What is Enthalpy? What is Internal Energy?
8. What is the thrust equation? Is it temperature-dependent?
9. How do you design an airfoil? How do you select which airfoil to choose for a UAV?

1. Beams: Shear force and Bending Moment diagram.
2. Shear vs. strain diagram.
3. Different engines and components of an engine.
4. Different thermodynamic processes and cycles used.
5. Impulse, specific impulse: units and definitions.
6. Equations for thrust and drag.
7. What are different composites used?
8. Explain Two Line Element (from internship).
9. Name the Indian Astronaut who went to space recently. What did he do there at the space station?
10. Different flows: Laminar, Turbulent.
11. Different types of materials used in different sections of a spacecraft.
12. Why do we use various materials instead of just one?
13. What are the control surfaces of a spacecraft and their uses?
14. Different types of wings and why we use different types.
15. What are you interested in? What are your favourite subjects?
16. What is stability?
17. Modes of heat transfer: conduction, convection, radiation equations.

1. Introduce yourself.

**2. Internship (CFD):**

- Explain your solving methodology.
- What is a grid? What are its properties? How did you make the grid? Structured/unstructured?
- Which scheme are you using and why? Explicit/implicit?
- What equations are used?
- What were the flow properties (velocity, Mach no., flow region)? Why analyze this as incompressible/compressible?

**3. Internship (Orbital Mechanics):**

- Explain orbital elements.
  - Hohmann transfer assumptions.
  - Time to reach the Moon. Why did Apollo reach the Moon faster?
  - Questions on Mars missions (VOM).
4. Draw a C-D Nozzle and write all 5 governing equations. What is a choked nozzle? Role of a nozzle and how it generates thrust.
5. PSLV: Why does it have stages? Why not a single stage? Is specific impulse ( $I_{sp}$ ) the reason for multiple stages?
6. Name the propellants (solid, liquid). What is the Vikas engine? In solid propellants, what are the oxidizer, fuel, and binder?

**7. Structures:**

- Bending and axial stress diagrams.
- Thrust direction in a rocket.
- Buckling.
- Aeroelasticity.
- Composites: what type, why use them? Compare Al and steel (yield strength, stiffness, strength density).
- Material used in the 1st stage.
- What forces act on a rocket and where? What are the resulting stresses?

**Suggestions & Feedback**

**Feedback:** Study the mentioned subjects and internship in detail. Also have an idea of Propulsion and Structures. Maintain confidence and the same energy even if you are not able to answer.

1. Do you know about any separation mechanism? Draw a section of a Marman band and the taper of the 2 sides.
2. How does gun recoil work?
3. During docking, a spacecraft will recoil. How can we avoid that?
4. In a separation mechanism, how does the velocity of separation change if the spring stiffness 'k' is doubled?
5. What are different types of airfoil? What is an aerofoil? Why is it called an aerofoil?
6. What do the digits in the NACA series mean? Draw and show.
7. The nose of a spacecraft is an ogive shape, why not a cone structure?
8. What is the force over an aircraft?
9. What is separation? Draw the Boundary Layer profile for attached and separated flow.
10. What is the Boundary Layer equation?
11. Plot  $C_L$  vs  $C_D$  for a wing and an airfoil.
12. What is skin friction?
13. What is a drag polar? What is its equation?
14. What is induced drag?
15. Compare solid vs. liquid propellant. What do you know about solid propulsion?
16. Draw the T/P/V profile across a C-D nozzle.
17. Draw a diamond airfoil. Draw the shock profile across a diamond airfoil. Show the expansion fan and shocks.
18. Explain overexpanded/underexpanded flow.
19. What was the first satellite launched by India?
20. What is IRNSS? (Asked about other satellites)
21. What changes across a shock (e.g., Mach no.)?
22. What are the exhaust gases in rocket propulsion? Are they harmful?
23. What is green propulsion?
24. What is Specific Impulse? What factors influence specific impulse?

**Areas of Interest****Subjects of Interest:** Space flight mechanics, structures**Interested Work Area:** Orbital Mechanics**Interview Questions**

1. When a spacecraft is detached from a rocket, how is momentum conserved?
2. What are the control surfaces on a spacecraft and an aircraft?
3. What is the difference between Earth's and Martian atmospheres?
4. How is drag defined? What changes drag? How does velocity in the drag equation change?
5. What are the types of orbits and their applications? Draw the orbits.
6. What are the orbital elements? What is the full form of RAAN? Why do orbits have inclination?
7. Aircraft stability: static, dynamic, stability conditions.
8. Plot pitching moment vs  $\alpha$ .
9. Discuss nose cone shapes, their advantages and disadvantages, and in which launch vehicle they are used. Draw the pressure distribution around them.
10. What is the difference between a sounding rocket and a launch vehicle from a flight dynamics perspective?
11. Types of heat transfer. Insulators: conductivity, specific heat. What are typical values for insulators?
12. When was the first satellite launched? Which one was it? Which country launched it? Why is space week celebrated?
13. Which launch vehicle carried the highest number of satellites? How many were there?
14. Solid and liquid propellants. How are they prepared? How are they ignited? Explain the mechanism. What are hypergolic propellants?
15. What is the orbit of communication satellites? What are GTO and GSO, and their altitudes? What is the speed and time period of a GSO satellite?
16. Draw the Stress-strain curve for metal and composites. What is the difference between metal and composites?
17. What is plasticity?
18. What is ablation? What is sublimation?
19. What forces are acting on a spacecraft?
20. What are the control surfaces used on an RLV?
21. What is Von-Mises stress?
22. What are the components of a solid rocket motor?

### **Suggestions & Feedback**

#### **Suggestions:**

1. Thoroughly revise all subjects from the first semester.
2. Read block diagrams and summaries from Anderson's books.
3. Keep explaining while drawing/writing on the whiteboard.

1. What is an orthotropic material?
2. What is a composite material and its principal direction?
3. For a vertical beam with no boundary conditions, if a force is applied, what is the acceleration distribution?
4. What are the different types of orbits?
5. How does an interplanetary orbit transfer work?
6. What is orbit determination and what are its elements?
7. What is a launch vehicle? What is the control system in it?
8. (Regarding an internship on a 3DOF Trajectory simulator) What is the difference between point motion and your model? Which launch vehicle did you use?
9. What have you studied in fluid mechanics?
10. Derive Bernoulli's equation from the Navier-Stokes equation.
11. What is its application? Give one example.
12. What is buckling? Explain strain energy and some relations.
13. Have you studied air-breathing propulsion?
14. What are the different types of propulsion? What are their applications?
15. What is bypass ratio?
16. Questions about which propulsion system is better, at what altitude they work, and different performance parameters (e.g., TSFC, T/W).
17. Questions related to different ISRO Missions and general knowledge.

1. Explain Mohr's circle.
2. What is the hygroscopic property?
3. Tell me about GSLV, PSLV, LVM3.
4. Write the Navier-Stokes equation and explain how you will solve it for compressible flow's different regimes.
5. What is laminar flow? What is turbulent flow?
6. Why is a solid rocket motor called a 'motor' and a liquid rocket engine called an 'engine'?
7. What are the different types of nozzles?
8. What is  $I_{sp}$ ? Which has higher  $I_{sp}$ : air-breathing engines or rockets?
9. What are the different types of combustion instabilities? (e.g., low-frequency instabilities)
10. What are combustion instabilities in a solid rocket motor?
11. What are O-rings and their applications?
12. For pressure vessels, what is the hoop stress formula?
13. What oxidizer is used in a solid rocket motor?
14. What are Kepler's laws?
15. Define Mach number and Reynolds number.
16. What is NISAR?
17. Why did a recent ISRO mission fail? What is the next ISRO Mission?



1. Rocket thrust equation. Draw the thrust vs. time graph for solid, liquid, and cryogenic engines.
2. GSLV & PSLV: propellants, uses, and orbits they are used for.
3. Sounding rocket parts and their uses.
4. Laminar vs. Turbulence.
5. What are Non-Destructive Tests (NDT)?
6. What are turbulence models?
7. Draw a nozzle diagram.
8. How to solve for flow over an airfoil?
9. What is potential flow?
10. What materials are used in ISRO rockets?
11. Draw the graph of Thrust &  $I_{sp}$  vs. Altitude.
12. What is a hypergolic propellant?
13. What is the governing equation for flow?
14. Draw the pressure plot along an airfoil surface.
15. What is vorticity?
16. What are the GSLV control systems?

**Areas of Interest****Subject of Interest:** Thermodynamics, Compressible flow**Interview Questions**

1. Define compressible flow in terms of Mach number.
2. What is hypersonic flow? Draw the flow regime of a re-entry vehicle.
3. What happens at hypersonic velocity?
4. What is the difference between stress and strain? How do you measure stress? Define strain.
5. What is stress concentration?
6. What is the use of Ansys software? What parameters do we evaluate there?
7. What is the use of a CAD model?
8. How do you solve for the properties in a region of hypersonic flow?
9. Define Continuum.
10. What is the difference between solid, liquid, and hybrid propulsion?
11. What is  $I_{sp}$ ?
12. Define Characteristic velocity ( $c^*$ ). How do we find  $c^*$ ?
13. What are the input parameters for NASA CEA (Chemical Equilibrium with Applications)?
14. What are the typical  $I_{sp}$  values for solid and liquid propellant engines?

1. Draw the nozzle.
2. Acoustics: What is the SPL (Sound Pressure Level) while talking, in industries, for aircraft, and for rockets?
3. How can SPL be reduced?
4. Write the stress tensor. What are principal stresses?
5. What is the launch vehicle for the Gaganyaan Mission?
6. How many types of launch vehicles are there in ISRO?
7. What is the Divergence theorem?
8. What is a wind tunnel?
9. What is Buckingham's  $\pi$ -theorem?
10. Draw the  $C_L$  vs  $\alpha$  curve for a rectangular and trapezoidal wing.

1. What is specific strength?
2. What is specific stiffness?
3. What are the different types of beams?
4. Draw a Bending Moment Diagram.
5. What is the difference between struts and columns?
6. What is the Euler buckling formula?
7. What is resonance?
8. What is damping and what are the different types of damping?
9. What are the different types of nozzles?
10. How do we design nozzles?
11. What are the different materials used in designing nozzles?
12. What are the different Mach number regimes?
13. What are the different types of launch vehicles used by India?
14. Name some foreign space vehicles.
15. What are the different similarity parameters used in a wind tunnel?

**Areas of Interest**

**Subject of Interest:** Heat transfer, Fluid Mechanics, BLT, CFD (Computational methods)

**Interview Questions**

1. Introduce yourself.
2. (Regarding internship) How was CFD used and what did you achieve? What boundary conditions were used? What governing equations and numerical schemes were used?
3. (Regarding Pointwise) Explain the mesh formation process. Explain structured vs. unstructured mesh, elements, nodes, and inflation layers.
4. Explain different numerical schemes: upwind, implicit, explicit.
5. What are the different types of heat transfer and their equations? Relate where each is happening in different parts of a rocket.
6. Explain different property numbers like Reynolds (Re), Prandtl (Pr), and Biot (Bi) numbers.
7. Write and explain the bending beam equation.
8. Question related to natural frequency.
9. What are conic sections? Explain how they can be obtained from cones (by cutting planes).
10. Explain linear and non-linear functions, maxima, and minima.
11. Questions from the application of metallurgy in rockets.
12. Questions about material composition.
13. Rocket topics: metals and materials used in boosters, tanks, etc.

**Areas of Interest****Topic of Interest:** Heat transfer, structures**Interview Questions**

1. What are the modes of heat transfer? Write all the governing equations. Name the equation and give one real-life example for all modes of transfer.
2. Write the thrust equation for a rocket.
3. What is the choked flow condition?
4. Explain the variation of exit pressure.
5. If a nozzle is punctured, what will happen to the thrust?
6. Do you know the typical values for all heat transfer constants like  $k$  and  $h$ ?
7. What is the Boltzmann constant?
8. Define heat flux. How do we measure it?
9. Define hardness. Name a test to measure it.
10. What is the Charpy impact test?

1. What is a C-D Nozzle?
2. If we keep adding C-D nozzles one after another, how will it affect the flow? How do stagnation quantities change in the above case?
3. What is buffeting?
4. What is a supersonic wing?
5. Describe the flow on a supersonic wing at supersonic speeds.
6. Describe the flow on a flat plate. How will pressure vary on the surfaces above and below a flat plate? Will it be uniform?
7. Tell me about solid and liquid propulsion. What are the applications of a solid engine?
8. Where is solid propulsion used in aerospace? In a rocket, why is solid prop used?
9. Which is more complex: solid or liquid propulsion? Why is liquid propulsion complex?
10. Name some liquid and solid engines used by ISRO.
11. What does  $I_{sp}$  depend on? What are the ranges of  $I_{sp}$  for liquid, solid, cryo, and semi-cryo engines?
12. What are the properties of liquid propulsion (e.g., controllability)?
13. What is hybrid propulsion?
14. Why is a C-D nozzle used in a rocket? What is choked flow?
15. What is the temperature range in a combustion chamber?
16. How is thrust generated by a nozzle? How can we increase  $I_{sp}$ ?
17. What is detonation?
18. What are composites? Where are composites used in a rocket? Why do we use composites (properties)?
19. What metals are used in a rocket and what are their properties (e.g., yield strength range)?
20. Questions about your internship.
21. What was India's first communication satellite?

**Areas of Interest****Interests:** Aerodynamics, Fluid Mechanics, Reinforcement Learning, Control Systems**Interview Questions**

1. Introduce yourself.
2. What are the aerodynamic components of a rocket? How do you control it?
3. How do you define stability in a rocket? Draw a FBD of forces acting on a rocket.
4. What are the non-dimensional numbers in Aerodynamics?
5. Explain the range of Reynolds number for different flows. What are those different flows (Laminar & Turbulent)?
6. What are the Aerodynamic Center & Center of Pressure? Mark those on a rocket. Mark those on an aerofoil.
7. What is the Boundary Layer (BL)? ( $0.99U_\infty$ ) Mark the boundary layers on the aerofoil. Draw the velocity profile in both Laminar & Turbulent flow.
8. Explain your internship. What did you do in Control systems there?
9. What is an open and closed loop system? What type of sensors have you studied in control systems (PID)?
10. Draw a streamline, streakline, and pathline on an airfoil.
11. What is the NACA Series (4 series & 5 series)? Go to the board and explain for NACA 1123.
12. Have you studied Space Flight Mechanics? Tell me the different angles (e.g.,  $\Omega$ ). Tell me other parameters besides eccentricity,  $e$ .
13. What is enthalpy? What is the difference between Internal energy and Enthalpy?
14. What did you study in the previous class of rocket propulsion?
15. What are the mechanisms used for maneuvering a rocket nozzle? How do you control the nozzle?
16. What is the difference between a sounding rocket and a Launch Vehicle?
17. Which is more stable? Is CoP above or below CG? How do you find the aerodynamic parameters?
18. How do you calculate lift? How do you calculate lift without a wind tunnel, theoretically? (Ans:  $L = \rho_\infty V_\infty \Gamma$ ) What is  $\Gamma$ ?
19. What is the stability criteria (AFM)?
20. What is Acoustic Velocity (speed of sound)? How is it dependent on Temperature and Pressure?
21. Design an airfoil for incompressible flow.

**Suggestions & Feedback****Remarks:** Study Thermodynamics and Space Flight Mechanics. Have a touch on the basics of all subjects.



1. About Internship.
2. What is supersonic flow? The regime range. How is it special? Is supersonic flow an irreversible flow or a reversible flow?
3. Types of shocks. Criteria for a detached shock. Prandtl-Meyer relation.
4. Difference between FEM, FVM, FDM.
5. How many satellites are currently operating around the world? How many of them are from India?
6. What is GSO and LEO?
7. For spacecraft, what propulsion systems are used? Name some propellants.
8. What is a monopropellant?
9. What are hypergolic systems? Hygroscopic systems?
10. What oxidizer is used for mixed solid propellant? (Basically, solid propellants have fuel + oxidizer)
11. Correlation Laws?
12. Frozen flow & Equilibrium Flow. Which has more specific impulse?
13. What are other unconventional nozzles? Why are Aerospike nozzles used?
14. Generally, how many nozzles are present in a solid propulsion system?
15. What is the general mass flow rate in a solid propulsion system?
16. Name solid rockets of ISRO.
17. What are the subsystems of a solid propulsion system?
18. Name liquid rocket engines of ISRO. The Vikas engine was inspired by what?
19. Applications of solid propulsion systems other than rockets.
20. What are pyro igniters? Pyrotechnic composition?
21. Detonation and Deflagration?
22. What is a Scramjet? At which Mach number does combustion occur?

1. Draw the nozzle for a rocket. Let's say we have two altitudes, 20 km and 10 km, and the nozzle is designed for 20 km. What kind of flow do we see in the nozzle at each altitude and also above 20 km?
2. Which kind of flow is preferred in a nozzle and why? What is the major loss that occurs in the nozzle?
3. How do we make it so that the nozzle is efficient over a large range of altitudes? What is the mechanism used to do so?
4. What happens to the flow if there is a hole in the divergent section of the nozzle?
5. What mechanism is used for heat transfer in a rocket, where are they used, and why? Give examples.
6. How is the payload fairing separated? How are stages separated? Mention the working of the mechanisms used.
7. Why are bolts preloaded? Draw the Load in Bolt vs. Applied Load Diagram.
8. Draw an airfoil and list the process that will be used to do CFD analysis on it.
9. What is CFD and why is it used? What equations are used for doing CFD analysis of fluid flow?

1. Explain lift distribution over a wing.
2. What are the control systems used in rockets?
3. Explain the use of fins in aircraft & rockets.
4. Write the rocket equation & thrust equation.
5. Define Knudsen no. and Prandtl no.
6. Draw the stress-strain curve for Al 6061, including its E and UTS values.
7. What are FRP materials (CFRP, GFRP)?
8. What was the first satellite launched? First communication satellite launched? What is Space Week?
9. Name some communication satellites and earth monitoring satellites.
10. What is strain energy?
11. Draw the pressure distribution around an airfoil.
12. What do you understand by the stability of an aircraft?
13. What computational methods are used to find the lift distribution over an airfoil?
14. What steps should one take for vehicle designing?
15. What is orthotropy?
16. What is Engineering Stress & True Stress?

1. Introduce yourself.

2. **Internship Topic:**

- Draw different flight segments of a rocket.
- Have you seen fins on a rocket? What is their purpose?
- Define Aeroelasticity. Can paper be used as a Control Surface?
- What variables did you model? What was the objective function you optimized?

3. **Elective Topic (High Temperature Gas Dynamics):**

- What are multi-staging rockets?
- What is the effect of high temperature on molecules? What effect does it have on the internal energy of the system?
- What is ablation? What are general ablative materials?
- What is heat flux? Do you have an idea about the general range of flux experienced by launch vehicles?
- What are the heat insulation devices present in a launch vehicle?

4. **Flight Dynamics:**

- What is the condition for neutral stability? What is the stability margin?
- What is the use of fins for the purpose of stability?
- What are the conditions for the stability of an aircraft?

5. What is thrust vectoring? How do we control it?

6. Define general aeroelasticity terms (e.g., flutter).

7. What is induced drag and induced angle of attack?

1. Introduce yourself.
2. In FEM analysis, which factor do you look at first?
3. What are PSLV and GSLV? Payload capacity? Orbit?
4. What is drag?
5. How do you measure pressure in acoustics? Theoretical methods or experimental?
6. In a converging-diverging nozzle, what is under-expanded and over-expanded flow?
7. What is a choked flow?
8. What are the isentropic relations for pressure, density, and temperature?
9. What is the formula for SFC? What is 'S' in this formula?
10. What is acoustics? How does it affect the structure or environment?
11. What is entropy? What is enthalpy? What is internal energy?
12. What is isentropic flow?
13. What is fluid-structure interaction?
14. In which Mach number regime is acoustics applicable?
15. Explain all laws of thermodynamics.
16. Draw a Temperature vs. Entropy/Enthalpy graph.
17. What propellants are used in rockets? What about solid propellants? Why do we use solid propellants?
18. What is the difference between orthotropic and isotropic?
19. What is acoustic coupling?
20. Which launch vehicle is for Gaganyaan?
21. What is the thrust equation? What is the equation in a vacuum?
22. Describe a wind tunnel.
23. What is  $I_{sp}$ ?
24. Why are we so concerned about the atmosphere or weather at the time of launch?
25. Draw the triangle relating fluid, structure, and acoustics (aero-servo-elasticity triangle).
26. What is a geosynchronous orbit? What is the velocity of a satellite in it?
27. What are some general Indian materials used in rockets?

1. What is a projectile? Draw a trajectory. What are the parameters of a trajectory?
2. What are fins? What is their cross-section?
3. What is aeroelasticity? (Buffeting, Fluttering, Vortex shedding)
4. What are statically determinate & indeterminate structures? Draw one.
5. Different types of orbits.
6. Different types of launch vehicles (LVs) like PSLV, GSLV, GSLV MkIII.
7. What are the elements of an orbit? ( $\Omega, \omega, \nu, i, a, e$  - RAAN, Argument of Periapsis, True Anomaly, Inclination, Semi-major axis, Eccentricity)
8. What is CFL? What is its purpose?
9. What is the trajectory of a sounding rocket?
10. What are the different types of heat transfer?
11. What is heat flux? What is its unit? How do you calculate it?
12. What is Prandtl number? What is Nusselt number?
13. Name some satellites in LEO (Low Earth Orbit).
14. What is the difference between Newtonian & non-Newtonian fluids?
15. What did you learn in Boundary Layer Theory? What is the formula for boundary layer thickness? (e.g.,  $\delta/x = 5/\sqrt{Re_x}$  for laminar flow)
16. What is momentum thickness & energy thickness?
17. Why do we give a roll to a sounding rocket? How do we give it? (Tilted fins)
18. Directional stability of a rocket. What is its equation?
19. What is an aerodynamic moment? How does it happen in a rocket? How do you counter the aerodynamic moment? (Control moment from fin/control surface)
20. Which is greater: aerodynamic or control moment?
21. What is the full form of Scramjet? (Supersonic Combustion Ramjet)
22. What is a ramjet? What are its parts? What is its operating range?
23. What is shear stress? What is its formula?
24. What is the flow regime of a rocket?
25. (Internship) For a simulation of a fin on a rocket, how will the solver settings change?