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भारतीय मानक मसौदा

**वैमानिक और खगोलीय शब्दों की शब्दावली
भाग 5 हवाई जहाज (हवा से भी भारी विमान)**

(पहला पुनरीक्षण)

Draft Indian Standard

**GLOSSARY OF AERONAUTICAL AND ASTRONAUTICAL TERMS
PART 5 AERODYNES (HEAVIER-THAN-AIR AIRCRAFT)**

(First Revision)

ICS 49.020

**Air and Space Vehicles Sectional Committee, Last date for receipt of comments is
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FOREWORD

(Formal Clause to be added later)

This standard is one of a series of Indian Standards on the glossary of aeronautical and astronautical terms. Other standards in this series are:

IS 7879 (Part 1) : 1975 Under revision (Doc No. 20706)	Glossary of Aeronautical And Astronautical Terms Part 1 General
IS 7879 (Part 2) : 1975 Under revision (Doc No. 20708)	Glossary of Aeronautical and Astronautical Terms Part 2 Motion of Aircraft
IS 7879 (Part 3) : 1975 Under revision (Doc No. 20757)	Glossary of Aeronautical and Astronautical Terms Part 3 Structure

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IS 7879 (Part 4) : 1980 Under revision (Doc No. 20759)	Glossary of Aeronautical and Astronautical Terms Part 4 Aerodynamics
IS 7879 (Part 6) : 1978 Under revision (Doc No. 20763)	Glossary of Aeronautical and Astronautical Terms Part 6 Space Terms
IS 7879 (Part 7) : 1984 Under revision (Doc No. 21135)	Glossary of Aeronautical and Astronautical Terms Part 7 Air Traffic and Ground Services
IS 7879 (Part 8) : 1987 Under revision (Doc No. 20768)	Glossary of Aeronautical and Astronautical Terms Part 8 Power Plant

The present standard provides standard definitions of technical terms relating to aeronautics, astronautics and related subjects. Terms in general use in other branches of engineering are also included where they have some special relevance to aeronautics or astronautics. The other parts of the standard cover terms specific to a particular feature, type of aircraft, equipment and services.

Each term has been, assigned a 4-digit or 5-digit number. The first one (or two) digit, in the thousandth place, represents the part number. This part number with the following digit in the hundredth place represents the section. The last two digits represent the position of the definition within a section. Thus, the term 5215 is the 15th definition of Section 52 which is in Part 5.

This standard was first published in 1982. The present revision has been taken up with a view to incorporating the modifications found necessary as a result of experience gained on the use of this standard. Also, in this revision, the standard has been brought into the latest style and format of Indian Standard, and references to Indian Standards, wherever applicable have been updated.

The following International Standards available on the subject have been referred by the technical committee in the course of preparation of this standard:

- a) BS: 185 'Aero - Nautical and Astronautical Terms'

The composition of the Committee responsible for the formulation of this standard is given at Annex A.

Draft Indian Standard

**GLOSSARY OF AERONAUTICAL AND ASTRONAUTICAL TERMS
PART 5 AERODYNES (HEAVIER-THAN-AIR AIRCRAFT)**

(*First Revision*)

1 SCOPE

This part covers the standard definitions for terms relating to aircraft heavier-than-air (Aerodynes).

2 REFERENCES

This standard does not contain any cross reference.

3 TERMINOLOGY

SECTION 51 COMPLETE AIRCRAFT

No.	Term	Definition
5101	Aeroplane	A power driven heavier-than-air aircraft with supporting surfaces which remain fixed under given conditions of flight.
5102	Canard aeroplane	An aeroplane with the surfaces providing the requisite longitudinal stability and control in front of the main plane.
5103	Landplane	An aeroplane capable of operating from a land surface.
5104	skiplane	A landplane provided with skis as a mass of support on snow-covered or ice-covered terrain.
5105	Pusher aeroplane	An aeroplane fitted with pusher propellers.
5106	Seaplane	An aeroplane capable of operating from a water surface
5107	Float seaplane	A seaplane provided with floats as its means of support on water.
5108	Flying boat (boat seaplane)	A seaplane whose main body or hull is also the means of support on water
5109	Tractor aeroplane	An aeroplane fitted with tractor propellers.
5110	Amphibian	An aircraft capable of operating from either a land or a water surface.

No.	Term	Definition
5111	Coleopter	An aircraft- having an annular wing, with the engine and body mounted within the annulus, and designed to take off and land with its wing axis vertical.
5112	Convertiplane	An aeroplane capable, by a mechanical conversion in the air, of landing and taking off vertically
5113	Glider	non-power-driven heavier-than-air aircraft (<i>see</i> 5301)
5114	Sailplane	A glider designed to utilize only atmospheric currents for sustained free flight
5115	Towed glider	A glider which relies on towing for sustained free flight.
5115A	Powered glider (motor glider)	A glider with a small power plant for short bursts of power for take off and/or in between gliding phases
5116	Kite	A non-power-driven heavier-than-air aircraft without controls, anchored or towed by a line.
5117	Mixed-power-plant aircraft	An aircraft whose power plant embodies more than one type of engine, each being usually appropriate to a particular flight regime.
5118	Monoplane	An aeroplane or glider with one pair of wings (<i>see</i> NOTE under 5123).
5119	High-wing monoplane	monoplane in which the wings are located at or near (shoulder-wing) the top of the fuselage.
5120	Low-wing monoplane	A monoplane in which the wings are located at or near the bottom of the fuselage
5121	Mid-wing monoplane	A monoplane in which the wings are located approximately midway between the top and bottom of the fuselage.
5122	Parasol monoplane	A monoplane in which the wings are united in a separate structure above the fuselage
5123	Multiplane	An aeroplane or glider with two or more sets of wings usually one above another, for example, biplane or triplane NOTE — Monoplane, biplane, triplane and multiplane are also used as adjectives associated with a particular component, for example, biplane rudder, triplane tail, etc.
5124	Ornithopter	A heavier-than-air aircraft supported in flight chiefly by the reaction of the air on wings to which a flapping motion is imparted.
5125	Rotor raft	A heavier-than-air aircraft which derives lift from a rotor or rotors
5126	Compound rotorcraft	An aircraft utilizing in flight features of both aeroplane and rotorcraft
5127	Cyclogyro (paddle-plane)	A rotorcraft on which the rotor is similar in form to a paddle wheel, power-driven about a horizontal axis
5128	Gyroplane	A rotorcraft with non-power-driven rotor(s) rotating about axes which are vertical or nearly so, when the aircraft is in horizontal flight.
5129	Helicopter	A rotorcraft deriving lift from power-driven rotor(s) rotating about axes which are vertical, or nearly so, when the aircraft is in horizontal flight.

No.	Term	Definition
5130	Sesquiplane	A biplane in which one pair of wings is of substantially less span than the other pair.
5131	Stol aircraft	A heavier-than-air aircraft designed to take off and land with a short ground run, either by the provision of powered lift or by the use of special aerodynamic devices.
5132	Tail-less aircraft (Flying wing)	An aircraft with its longitudinal control surfaces incorporated in the main plane
5133	Variable-sweep aircraft (swing-wing-aircraft)	An aircraft in which the sweep of the main plane can be varied in flight.
5134	Vtol aircraft	A heavier-than-air aircraft provided with powered lift, which can take off and land along a substantially vertical path.
5135	V/stol aircraft	A Vtol aircraft which can also take off and land with a short ground run, particularly when operating at an increased weight.

SECTION 52 SHAPE AND DISPOSITION OF SURFACES

No.	Term	Definition
5201	Aerofoil	A body so shaped as to produce aerodynamic reaction normal to the direction of its motion through the air without excessive drag.
5202	Annular aerofoil	An aerofoil generated by the rotation of its section about an axis substantially parallel to its chord and thus having an annular cross-section normal to that axis.
5203	Slotted aerofoil	An aerofoil having one or more air passages (or slots) connecting its two surfaces to delay separation (<i>see 4479</i>) and consequent stall.
5204	Slat	An auxiliary, cambered aerofoil positioned forward of the main aerofoil so as to form a slot.
5205	Aerofoil section	The shape of the boundary of a section of an aerofoil in a plane parallel to its plane of symmetry.
5206	Aileron drop	The simultaneous downward or positive deflection of the ailerons on both sides of an aeroplane or glider.
5207	Aileron up-float	The simultaneous upward or negative deflection of the ailerons on both sides of an aeroplane or glider.
ANGLES		
5208	Control surface angle	The angle between the chord of the control surface and the chord of the corresponding fixed surface (for example, aileron angle, elevator angle, elevon angle, rudder angle).

No.	Term	Definition
5209	Decalage	The angle between the chord of the upper plane of a biplane and that of the lower plane in a section parallel to the plane of symmetry.
5210	Dihedral	The angle at which, in an aeroplane or glider, the port and starboard parts of the main plane or tailplane are inclined upwards to the transverse plane of reference. If the inclination is downwards, the angle is termed anhedral or negative dihedral.
5211	Sweep (back or forward)	The angle in plan between a specified spanwise line along an aerofoil and the normal to the plane of symmetry. For an aerofoil as a whole, the quarter-chord line is preferred, but any other specified line, such as the leading on trailing edge, may be taken for a particular purpose.
5212	Tail-setting angle	The angle between the root chord of the main supporting surface and the chord of the tailplane.
5213	Wash-in	Increase in angle of incidence towards the tip of a wing or other aerofoil
5214	Wash-out	Decrease in angle of incidence towards the tip of wing or other aerofoil
AREAS		
5215	Gross wing area	a) The area of the surface bounded by the two wing tips and the leading and trailing edges continued to intersect in the plane of symmetry. b) The area of the surface bounded by the two wing tips, the leading and trailing edges and by straight lines joining their intersections (ignoring fillets) with the fuselage and wing nacelles.
5216	Net wing area	The gross wing area less the part covered by the fuselage
5217	Aspect ratio	The ratio of the square of the span to the gross area of an aerofoil.
5218	Camber	a) Curvature of the median line of an aerofoil section: more generally, the curvature of a surface. b) The ratio of the maximum height of the median line above the chord to the chord length
5219	Conical camber	The camber of an aerofoil having a surface derived from a cone (not necessarily right circular) with its apex lying in the plane of symmetry of the aircraft
5220	Chord	The straight line through the centre of curvature at the leading and trailing edges of an aerofoil section.
5221	Standard mean chord (first mean chord)	A chord of length equal to the gross wing area divided by the span.
5222	Aerodynamic mean chord (second mean chord)	A chord of length defined by;

No.	Term	Definition
		$\frac{1}{S} \int_{-\frac{b}{2}}^{\frac{b}{2}} C^2 dy$ <p>where C = chord length at distance y from the plan of symmetry, b = span, and S = gross wing area</p>
5223	Chord length	The length of that part of the chord which is intercepted by the aerofoil section boundary.
5224	Chord position	The position of the chord as defined by the co-ordinates (x , y , z) of its quarter-chord point referred to body axes and its inclination (θ) to the x - y plane.
5225	Quarter-chord line	The line through the quarter-chord points of an aerofoil.
5226	Quarter-chord point	The point on the chord of an aerofoil section at one quarter of the chord length behind the leading edge.
5227	Gap	Of a multiplane. The distance between the leading edge of a plane and of the one below it, measured parallel to the normal body axis.
5228	Geometric twist	Variation, along the span of a wing or other aerofoil, of the angle between the chord and a fixed datum. (<i>see 4102</i>).
5229	Leading edge	a) The forward edge of an aerofoil or other body moving through the air. b) The forward portion of the structure of an aerofoil.
5230	Supersonic leading edge	A leading edge designed for flight at supersonic speed, its sweep being greater than the complement of the Mach angle. The component of the stream velocity normal to the leading edge is, therefore, sonic.
5231	Medium line (centre line) (camber line)	Of an aerofoil. A line, each point of which is equidistant from the upper and lower boundaries of the aerofoil section, the distance being measured normal to the chord.
5232	Ogive	a) The outline of a Gothic arch; and b) The solid of revolution produced by rotating such an outline about its centreline.
5233	Tangent ogive	An ogive whose tangent at its base is parallel to its centreline.
5234	Overhang	a) The extent to which the 'tip of one of two superimposed planes projects beyond the tip of the other; and b) The distance from the outer point of support to the tip of a plane.
5235	Rigging	The relative adjustment or alignment of the different components of an aircraft.

No.	Term	Definition
5236	Rigging angle of incidence	The angle between the chord of the main plane or tailplane and the horizontal when the aeroplane is in the rigging position. NOTE — Not to be confused with aerodynamic angle of incidence, 4104.
5237	Rigging position	The attitude in which, with the lateral axis horizontal, an arbitrary longitudinal datum line is also horizontal
5238	Span	a) Of an aeroplane. The distance between the wingtips; and b) Of an aerofoil. The length along a specified line.
5239	Stagger	Of a multiplane. The distance between the leading edge of a plane and of the one below it, measured parallel to the longitudinal body axis.
5240	Thickness/chord ratio (thickness ratio)	The ratio of the maximum thickness of an aerofoil section measured perpendicular to the chord, to the chord length.
5241	Trailing edge	a) The rear edge of an aerofoil or other body moving through the air; and b) The rearward portion of the structure of an aerofoil.
5242	Wave rider	A lifting body, designed for flight at supersonic or hypersonic speeds, which relies essentially on a shockwave, or system of shockwaves, beneath its lower surface for producing its lift force
5243	Channel-wing	A wing formed, in the way of the propeller, into an open semi-circular channel through which the slipstream from a propeller passes.
5244	Delta wing	A wing of triangular planform.
5245	Gull wing	A wing whose inboard section has pronounced dihedral and whose outboard section has either anhedral or markedly less dihedral.
5246	M-wing	A wing whose inboard section is swept forward and whose outboard section is swept back, thus forming roughly an M in plan view.
5247	Tapered wing	A wing in which there is progressive decrease in chord length from root to tip.
5248	W-wing	A wing whose inboard section is swept back and whose outboard section is swept forward, thus forming roughly a W in plan view.

SECTION 53 COMPONENT PARTS

No.	Term	Definition
5301	Airframe	A power-driven heavier-than-air aircraft without its engine(s).
5302	Control lock (gust lock)	A mechanical device designed to safeguard, by a positive lock, the control surface and flying control system against damage in high winds or gusts when the aircraft is parked.

No.	Term	Definition
5303	Doping	Treatment of a fabric surface to tauten, strengthen or render it air-tight.
5304	Fence	A projection from the surface of the wing and extending chordwise to modify the wing surface pressure distribution.
5305	Fin	A fixed vertical surface designed to provide directional stability. A fin projecting from the upper or lower surface of the body is referred to as dorsal or ventral respectively.
5306	Plane (aerofoil)	A body so shaped as to produce aerodynamic reaction normal to the direction of its motion through the air without excessive drag.
5307	Main plane	The main supporting surface of an aircraft, usually divided into port and starboard wings
5308	Noseplane (fore plane)	An aerofoil fixed, movable or adjustable in flight, located forward of the main plane contributing to longitudinal control and/or stability.
5309	Stub plane	A short length of plane projecting from the fuselage or hull (usually forming a part thereof) to which an aerofoil can be connected
5310	Ailplane	An aerofoil fixed, movable or adjustable in flight, located after of the main plane, contributing to longitudinal control and/or stability.
5311	All moving tail (flying tail) (slab tail)	A tailplane such that the movement of the whole surface is used for longitudinal control
5312	Supporting surfaces	Surfaces, the primary function of which is to provide lift for an aircraft.
5313	Tail unit (empennage)	The combination of stabilizing and controlling surfaces situated at the rear of an aircraft.
5314	Wing	A main supporting surface of an aircraft. This may be divided into inner, outer and wing-tip sections. (<i>see 5307</i>).
5315	Centre section	The middle or central section of a wing, to which the outer wing panels are attached. Where a wing has no clearly defined central section, the centre section is considered to lie between points of attachment of the wing to the fuselage or fuselage struts.
FLIGHT CONTROLS		
5316	Aerodynamic balance	<ul style="list-style-type: none"> a) Reduction of the hinge moment opposing rotation of a central surface by so disposing the surface that part of it is forward of the hinge or by fitting a balance tab to it; and b) A device to reduce the hinge moment of the control surface.
5317	Horn balance	A localized balance area at the tip of a control surface. This may be shielded by a surface in front

No.	Term	Definition
5318	Shrouded balance	A balance with control area forward of its hinge and operating within a space bounded by shrouds which form part of the aerofoil contour.
5319	Internal balance	A shrouded balance with an overhang which leaves a small gap between itself and a shaped part of the aerofoil structure, so as to control aerodynamically the state of balance at any position.
5320	Sealed internal balance	An internal balance in which the overhang gap is sealed with a brush or by a flexible partition.
5321	Ailerons	Pairs of control surfaces, normally situated at the trailing edge of the wing structure, designed to control an aircraft in roll by their differential movement
5322	Anti-yaw ailerons (frise ailerons)	Ailerons which maintain a smooth upper surface with the wing when moved down, but have a nose which projects below the lower surface when moved up, thus increasing the drag of the down-moving wing
5323	Differential ailerons	Ailerons geared so that, when they are deflected, the up-going aileron moves through a different angle from the down-going aileron. In practice, the up-going aileron moves through the greater angle, in order to reduce adverse yaw and/or to lessen the pilot's effort.
5324	Slotted aileron	An aileron whose leading edge is so shaped that the slot between it and the wing improves the flow over its upper surface when the aileron is deflected downwards.
5325	Air brake, dive brake	Any device primarily used to increase drag of an aircraft at will.
5326	Dive flap	A flap-type air brake used to reduce the limiting velocity of an aircraft.
5327	Automatic control	The state in being when the control surfaces and/or engine controls are automatically operated in accordance with signals detected by instruments and with no pilot control through flying controls.
5328	Autopilot (automatic pilot automatic flight control system)	A control system which will automatically manoeuvre the aircraft into, and stabilize it with respect to, a demanded flight condition determined by a computer (human or otherwise) inside or outside the aircraft.
5329	Auto-stabilizer	An automatic device which improves the natural stability of an aircraft by operating control surfaces independently or as part of a pilot control system in such a way that the human pilot retains continuous control through his normal flying controls.
5330	Balanced surface	control surface embodying aerodynamic balance
5331	Control column	The lever, or the pillar supporting a handwheel, or its equivalent, by which the longitudinal and lateral controls are operated.
5332	Control surface (motivator)	An aerofoil or part thereof which moves to produce changes in the forces and/or moments acting on an aircraft in order to control it. (An output element of a flight control

No.	Term	Definition
		system).
5333	Elevator	A flap-type control surface designed to control an aircraft in pitch.
5334	Elevons	Control surfaces combining the functions of ailerons and elevators. When placed on the tail, they are sometimes called tailerons. Elevons in the form of all-moving wing tips have been referred to occasionally as controllers or stabilizers.
5335	Feel	The sensations of force and displacement experienced by the pilot, from the air forces on the control surface, through those limbs which are in contact with the flying controls.
5336	Artificial feel system	A device which simulates or augments natural feel when the control surfaces are operated mechanically. Its purpose is to provide additional information regarding the state of control in order to simplify the pilot's task
5337	Q feel system	An artificial feel system in which the feel force is Proportional to the square of the equivalent airspeed.
5338	Spring feel system	An artificial feel system in which the load required to move a flying control in the absence of air forces is dependent on the displacement from the trimmed conditions.
5339	Flap	Any surface usually forming part of the rear portion of a wing, adjustable in flight, the primary function of which is to increase the lift.
5340	Blown flap	Flap over the upper surface of which air or some other gas is ejected with sufficient momentum to increase its effectiveness.
5341	Dive flap	<i>See 5326</i>
5342	Droop flap, leading-edge flap	A flap at the leading edge of a wing, deflected downward to increase camber and thus improve stalling characteristics.
5343	Extension flap	A flap, the movement of which increases the effective chord length of the aerofoil, for example fowler flap, gouge flap.
5344	Plain flap	A flap forming the rear portion of the aerofoil and moving as a whole.
5345	Recovery flap	A flap, the operation of which so alters the pitching moment characteristics of an aircraft that recovery from a dive is automatic, or is made easier to the pilot.
5346	Slotted flap	A flap whose leading edge is so shaped that the slot or slots between it and the wing improve the flow over its upper surface when the flap is deflected downwards.
5347	Split flap	A flap inset into the lower surface of the aerofoil.
5348	Suction flap	A flap whose effectiveness is increased by boundary-layer suction.

No.	Term	Definition
5349	Flight control system	The arrangement of all control elements which enables control forces and torques to be brought into play by the human pilot or otherwise.
5350	Channel	That section of a flight control system which determines the application of a particular control surface, for example, elevator channel.
5351	Multiple channel	A channel containing multiple components connected together in such a way that alternative lanes exist for producing control surface application.
5352	Irreversible control system (irreversible control)	A flight control system in which the control surface can be moved freely by the pilot but cannot be moved by aerodynamic forces alone.
5353	Power-assisted control system	A flight control system in which a power amplifier is placed between the flying control and the control surface to supplement the pilot's direct effort.
5354	Powered control system	A flight control system in which a power amplifier is placed between the flying control and the control surface
5355	Flying controls	Input elements directly moved by the human pilot or otherwise, to operate the control surfaces.
5356	Jet flap	A sheet of high velocity air or some other gas ejected near the rear of a wing at an angle to the main air stream to increase the lift, thus performing the function of a flap
5357	Manoeuvre demand control system	A pilot control system in which the control surface deflections are automatically adjusted in accordance with the motion of the aircraft in such a way that a unique predetermined manoeuvre follows a single input by the pilot.
5358	Reaction control	Control of aircraft attitude and position by the reaction from compressed gas issuing from nozzles or by the thrust from jet engines
5359	Rudder	A control surface designed to control an aircraft in yaw.
5360	Rudder bar	The foot-bar by which the rudder is operated.
5361	Rudder pedals	Pedals by which the rudder is operated.
5362	Spoiler	A light, controllable device fitted on the upper surface of wings (usually at the rear), used for disturbing or spoiling air flow and thereby delay separation (<i>see 4479</i>).
5363	Interceptor	A spoiler mounted to intercept the airflow through a slot. Note-The term is also used to describe a type of military aircraft.
5364	Stick pusher	A device which gives a forward push to the control column when the aircraft approaches a hazardous stalled condition, thereby producing a nose-down pitch
5365	Stick shaker	A device which vibrates the control column to indicate approach to a hazardous stalled condition
5366	Tab	A fixed or hinged rear portion of a control surface or flap.
5367	Balance tab	A tab designed to reduce the effort required to operate a control surface.
5368	Controlled tab	A balance tab controllable in flight.

No.	Term	Definition
5369	Geared tab	A balance tab mechanically linked to a control surface so that its angular movement is determined by that of the control surface.
5370	Servo tab	A balance tab directly operated by the pilot to produce forces which in turn move the main surface.
5371	Spring tab	A balance tab, the angular movement of which is geared to the compression or extension of a spring embedded in the main control circuit. The primary purpose is to reduce the pilot's effort at high airspeeds.
5372	Trimming tab	A tab, the setting of which in relation to the main surface is separately adjustable by the pilot.
5373	Trimming strip (trailing edge card, trailing edge strip	A strip of metal or length of cord or wire, adjustable only on the ground, applied to the trailing edge of a control surface to modify the balance or trim.
5373A	Fly by wire	Method of actuating control surfaces by non-mechanical means, such as electrical or light signals
FUSELAGE, HULL, NACELLES		
5374	Afterbody	a) Of a flying boat hull. The portion aft of the step; and b) Generally. The rear portion of a fuselage or nacelle.
5375	Cabin	An enclosure for housing crew and/or passengers or cargo.
5376	Pressure cabin	A cabin in which means are provided to maintain the air pressure at a higher level than the ambient air pressure.
5377	Capsule	A pressurized compartment of an aircraft, housing crew members and capable of being ejected in an emergency.
5378	Cockpit	A compartment housing the pilot(s).
5379	Ejection gun	The explosively-operated ram mechanism of an ejection seat or capsule, or other body.
5380	Ejection seat	A seat capable of being ejected in any emergency to carry the occupant and his equipment clear of the aircraft.
5381	End plate	A plate or surface at the end of an aerofoil, attached in a substantially vertical plane parallel to the direction of flight. Its effect is similar to that of increased aspect ratio
5382	Face curtain	A flexible sheet, installed at the top of an ejection seat, which is pulled down to fire the ejection gun and to protect the face, oxygen mask, etc against wind blast during ejection.
5383	Flight deck	The compartment in an aircraft containing the operating stations of the flight crew
5384	Forebody	a) Of a flying boat hull. The portion forward of the step; and b) Generally. The forward portion of a fuselage or nacelle,
5385	Fuselage	The main structural body of an aircraft other than a flying boat or boat amphibian.

No.	Term	Definition
5386	Gosport	A flexible voice-tube between two cockpits in an aeroplane, used especially between a flying instructor and a student.
5387	Hull	The main structural and flotation body of a flying boat or boat amphibian
5388	Nacelle	A streamlined structure on an aircraft, separate from the fuselage, for housing crew, engines or other items of load.
5389	Pod	A nacelle supported externally from a fuselage or wing,
5390	planing bottom	The part of the under-surface of a hull or float designed to provide hydrodynamic lift.
5391	Sponson (stub)	A projection from a hull to give lateral stability on water.
5392	Step	A discontinuity in the under-surface of a hull or flat to facilitate take off.
5393	Tail boom	A cantilever carrying the tail unit of an aircraft in, which the fuselage does not perform this function.

SECTION 54 LANDING GEAR

No.	Term	Definition
5401	Landing gear	The part of an aircraft (other than the hull of a flying boat) provided for its support and movement over land, water or other surface, and for absorbing the shock on landing. It comprises the main supports (incorporating wheels, skids, skis) and auxiliary items, such as nose-wheels, tail-wheels or skids and wing-tip floats.
5402	Nose-wheel landing gear (tricycle landing gear)	A landing gear with a nose-wheel undercarriage
5403	Tail-wheel landing gear	A landing gear with a tail-wheel undercarriage
5404	Arrester hook (arresting hook)	A hook on an aircraft to engage arresting gear
CASTORING WHEEL		
5405	Axle offset	The length of the common normal to the castor axis and to the wheel axis
5406	Castor length	The distance between the centre of the tyre contact area and the intersection of the ground with the castor axis produced.
5407	Shimmy	An oscillation of a castoring wheel about the castor axis. It is excited when the wheel travels on a surface whose coefficient of friction exceeds a critical value
5408	Shimmy damper	A damper designed for suppressing shimmy
5409	Float	A water-tight body giving buoyancy and stability in roll on water to a seaplane or amphibian and enabling it to take off

No.	Term	Definition
		and land.
5410	Flotation gear	Emergency flotation appliances for aircraft.
5411	Hydrofoil	A surface, similar in form to an aerofoil, on a seaplane or amphibian hull or float to facilitate takeoff by providing hydrodynamic lift.
5412	Oleo (oleo leg) (oleo strut >	A telescopic structural member designed to dissipate the emergency at landing by the passage of oil under pressure through an orifice.
5413	Pedestal	The pillar connecting a ski to the aircraft.
5414	Retraction lock	A device preventing inadvertent retraction of the undercarriage.
5415	Spat	A fairing around the wheel of a fixed landing gear.
5416	Torque links	A linkage to prevent relative rotation between telescopic members.
5417	Track	The distance between the outer points of contact of the port and starboard main undercarriages.
5418	Undercarriage	A major assembly of the landing gear (main, nose, tail).
5419	Bicycle undercarriage	A main landing gear using two wheels or pairs of wheels in tandem.
5420	Bogie undercarriage	An undercarriage carrying a pair or pairs of tandem wheels pivoted at the end of a central strut
5421	Cross-wind undercarriage	An undercarriage which permits an aircraft to move crabwise in a straight line down a runway in the presence of a cross-wind.
5422	Retractable undercarriage	An undercarriage which can be withdrawn from its operative position, usually into the structure, to reduce drag
5423	Up-and-down lock	A lock on a retractable undercarriage to hold it in either the retracted or the operative position.
5424	Wheel base	The fore-and-aft distance between the main-wheel centre and the nose-wheel or tail-wheel centre.
5425	Wheel turning radius	The effective rolling radius of a pneumatic-tyred wheel. It is the radius of the circle whose circumference is equal to the distance moved forward by the wheel during a single revolution.

SECTION 55 INSTRUMENTS

No.	Term	Definition
FLIGHT INSTRUMENTS		
5501	Air-mileage	An indicating instrument which shows continuously and automatically the air distance flown.
5502	Air-mileage unit	An instrument which derives continuously and automatically the air distance flown and feeds this function into other automatic instruments.

No.	Term	Definition
5503	Air-position indicator	An indicating instrument which shows continuously and automatically the air position of an aircraft by calculation from inputs of heading and air speed.
5504	Air sextant	An instrument which determines the altitude of a celestial body, employing a special device to provide an artificial horizon. It may be fitted with a periscopic averaging, integrating or other special device.
5505	Airspeed indicator (ASI)	An instrument which indicates the airspeed as derived simply from the stagnation or total pressure.
5506	Maximum safe airspeed indicator	An airspeed indicator with an additional pointer which shows automatically the indicated airspeed corresponding to a predetermined limiting Mach number. In addition, there may be a mark on the dial showing the maximum permissible airspeed.
5507	Altimeter	device for indicating altitude
5508	Barometric altimeter (pressure altimeter)	An aneroid barometer graduated to indicate altitude according to a standard atmosphere.
5509	Cabin altimeter	An altimeter to indicate the equivalent altitude in a pressure cabin.
5510	Height indicator	An instrument in an aircraft for indicating the distance between it and the surface vertically beneath.
5511	Radio altimeter	A height indicator working on the radar principle.
5512	Artificial horizon	An instrument with a self-contained vertical gyro which displays the attitude of the aircraft elevation, and bank.
5513	Blind-flying instruments	Instruments specifically designed to supply a pilot with information sufficient for him to fly an aircraft using instruments only.
5514	Cable-angle indicator	An indicator showing the angle in the vertical plane, at the point of attachment, between a towing cable and the longitudinal axis of the towing or towed aircraft
5515	Chronometric tachometer	An instrument used to measure rev/min by the motion of a gear in a measured interval of time
5516	Dive-angle indicator	An instrument for indicating the angle between the vertical and the flight path of an aircraft in a dive.
5517	Flight instrument system	An arrangement of sensors and displays giving to the pilot information on the speed, orientation and flight path of an aircraft relative to a known datum
5518	Attitude director indicator	An instrument display which combines the functions of an attitude indicator and a flight director display. Other information to assist the pilot in a given manoeuvre, such as radio altitude, ILS deviation, and speed variation, is sometimes shown
5519	Attitude indicator	An instrument which displays the attitude of an aircraft in elevation and bank (and sometimes heading) the attitude information being transmitted from remote sensors and servo repeated within the instrument
5520	Flight display director	A display in which one or more symbols are shown related

No.	Term	Definition
		to a datum, the deviation of the symbols from the datum being controlled by processed information. By flying the aircraft to keep the symbols at the datum, the pilot carries out a predetermined manoeuvre in a prescribed manner
5521	Head-up-display	A display such that the readings of a group of flight instruments or other information can be superimposed upon the pilot's forward field of view.
5522	Gyro (gyroscope)	A spinning rotor, usually in a gimbal system, provided with one or more additional degrees of freedom
5523	Azimuth gyro	A gyroscopic instrument used in aircraft to establish an arbitrary azimuth datum and to measure the aircraft heading relative to it
5524	Caging device	A device for locking the gimbals of a gyro.
5525	Directional gyro	An azimuth gyro with a direct display and means for setting the datum to a specified compass heading
5526	Free gyro	gyro which is free from constraint
5527	Integrating rate gyro	A gyro with one degree of freedom other than the spinning one and so constrained that the deflection of the spin axis relative to the case is the time integral of the angular velocity of the case.
5528	Rate gyro	A gyro with one degree of freedom other than the spinning one and so constrained that the deflection of the spin axis relative to the case is a measure of the angular velocity of the case.
5529	Vertical gyro	A gyroscopic instrument used in aircraft to establish a vertical datum and to measure the aircraft attitude relative to it.
5530	Incidence indicator (angle of attack indicator)	An instrument for indicating the angle in the plane of symmetry between the flight path and longitudinal axis of an aircraft
5531	Machmeter	An instrument for measuring the Mach number
5532	Navigation display	A display of quantities defining the position of the aircraft relative to an arbitrary datum. It is common to obtain merely the plan position relative to the Earth.
5533	Pitot tube (impact tube)	A tube, with an open end facing up-stream, wherein at subsonic speeds the pressure is equal to the total pressure
5534	Pressure head	device which combines the pitot tube and static pressure tube in a form suitable for mounting on an aircraft.
5535	Side-force meter	An instrument for measuring changes in the external side force acting upon it, excluding gravity. If suitably positioned, it will give an approximate measurement of the sideslip.
5536	Sideslip display (sideslip indicator)	An instrument which displays variations in sideslip,
5537	Sideslip meter	An instrument for measuring the angle of sideslip

No.	Term	Definition
5538	Static vent	A small aperture in a plate fixed to form part of the fuselage and located appropriately for measuring the ambient static air pressure.
5539	Static-pressure tube	A small tube with an aperture or apertures for measuring the ambient static pressure
5540	Statoscope	An instrument for indicating small changes in altitude or variations from a pre-set altitude.
5541	Turn indicator	An instrument for indicating the rate of turn of an aircraft about the vertical axis
5542	Turn-and-slip indicator (turn-and-sideslip indicator)	An instrument which combines the functions of a turn indicator and a side-force meter
5543	Vertical speed indicator (rate-of-climb indicator, Variometer)	An instrument indicating the rate of climb or descent
5544	Yaw meter	An instrument which detects changes in direction of air flow. By usage, the term is not restricted to instruments detecting changes in yaw.
TEST INSTRUMENTS		
5545	Accelerometer	An instrument for measuring acceleration, for example, indicating accelerometer, maximum-reading accelerometer, recording accelerometer.
5546	Counting accelerometer (statistical accelerometer)	An accelerometer recording the number of times the acceleration has exceeded any or all of a number of predetermined values. Usually also records airspeeds and/or altitude at pre-set intervals.
5547	Fatigue load meter (fatigue meter)	A simple form of counting accelerometer presenting digital records of acceleration only and for a limited number of values.
5548	Impact accelerometer	An accelerometer used to measure the deceleration of an aircraft on landing
5549	Integrating accelerometer	A device, incorporating an accelerometer, which performs a single integration of the acceleration to derive the velocity and a second integration to derive the distance travelled
5550	Airflow meter	An instrument for measuring the flow of air in ducts
5551	Automatic observer	An apparatus for recording automatically the readings of a specified set of instruments in flight.
5552	Flight-path recorder	An instrument for recording the angle of the flight path to the horizontal.
5553	Flight recorder	A device recording information about the behaviour of an aircraft, its crew and/or the ambient conditions in flight
5554	Vg recorder	A flight recorder giving (usually graphically) simultaneous values of indicated airspeed and acceleration.

No.	Term	Definition
5555	VgH recorder	A flight recorder giving (usually graphically) simultaneous values of indicated airspeed and acceleration and altitude.
5556	VH recorder	A flight recorder giving (usually graphically) simultaneous values of indicated airspeed and altitude
5557	Hot-wire anemometer	An anemometer in which the speed of an airstream is deduced by the change in resistance of an electrically heated wire exposed to the stream
5558	Noise meter (audiometer)	An instrument for the measurement of some quality characteristic of the strength of a noise, for example, sound pressure level or intensity.
5559	Objective noise meter	A noise meter operating objectively, that is, without requiring from the user any subjective judgement of the magnitude of the quantity under measurement.
5560	Subjective noise meter	An instrument for the measurement of loudness by aural comparison with a reference sound
5561	Pitot comb	A group of pitot tubes deployed for simultaneous measurement of kinetic pressure at a number of points in an airflow.
5562	Recording altimeter (altitude recorder)	An instrument by which variation in altitude is recorded against time.

SECTION 56 LOADINGS AND WEIGHTS

No.	Term	Definition
5601	CG datum point	An arbitrarily chosen fixed point from which distances are measured to the centres of gravity of the various loads carried for the purpose of determining the position of the centre of gravity of the loaded aircraft.
5602	Load sheet	A document indicating, interalia, how the load is distributed and the resulting position of the centre of gravity of the aircraft.
LOADING AND LOAD FACTORS		
5603	Load factor (operational)	The actual payload as a percentage of the maximum permissible payload on a particular flight.
5604	Power loading	The gross weight of an aircraft divided by the horsepower of the engine(s).
5605	Span loading	The gross weight of an aeroplane or glider divided by the square of the span
5606	Surface loading	The mean normal force per unit area carried by a particular aerofoil under specified aerodynamic conditions,
5607	Wing loading (gross wing loading)	Gross weight divided by gross wing area
5608	Net wing loading	Gross weight divided by net wing area.
LOADS		
5609	Disposable load	a) Of a military aircraft. The fuel, oil and armament stores; and b) Of a civil aircraft. The crew, fuel, oil and payload.
5610	Maximum disposable load	The maximum licensed take-off weight less the empty weight of the aircraft. The empty weight includes all fixed equipment, fixed ballast, unusable fuel supply, undrainable oil, engine coolant and hydraulic fluid.
5611	Payload (commercial load)	That part of the useful load from which revenue is derived (that is, passengers, mail and freight)
5612	Useful load	The gross weight less the basic weight or weight empty.
WEIGHTS		
5613	All-up weight (total weight)	The total weight of an aircraft with the crew and contents on any particular occasion.
5614	Basic weight	That weight which includes all items declared as fixed operating equipment and trapped fuel and oil, to which it is only necessary to add the ' variable ' or ' expendable ' load items for the various missions.
5615	Certified landing (CL) weight	The design gross weight at which an aircraft capable of V/STOL is permitted to land conventionally.
5616	Certified take off (CTO) weight	The design gross weight at which an aircraft capable of V/STOL is permitted to take off conventionally
5617	Design gross weight	The design weight at which it is expected that an aircraft will meet the relevant specified airworthiness requirements
5618	Dry weight	For operational purposes, the gross weight of the aircraft less fuel.

5619	Gross weight	The weight of an aircraft with its crew and contents.
5620	Maximum weight	The maximum flying weight of an aircraft permissible under the regulations obtaining irrespective of operating conditions
5621	Maximum landing weight	The maximum weight at which an aircraft is permitted, due to design or operational limitations, to land except in an emergency.
5622	Maximum licensed take-off weight	Maximum take-off weight, according to the airworthiness certificate.
5623	Maximum take-off weight	The weight of the aircraft above which all weight must be in fuel or load in the wing.
5624	Operating weight (aircraft prepared for service weight) (APS weight)	The weight of an aircraft equipped for flight. Normally comprises the ‘basic weight’ plus those ‘variable’ items, which remain substantially constant for the type of mission. These include oil, crew, crew’s baggage, steward’s equipment and emergency and extra equipment that may be carried.
5625	Tare weight	For design purposes, the standard weight of a type of aircraft complete in flying order but without crew, fuel, oil, removable equipment or payload.
5626	VTOL weight	The maximum gross weight of a particular aircraft at which VTOL is possible.
5627	Weight empty	For operational purposes, the measured weight of an individual aircraft less non-mandatory removal equipment and disposable load.

SECTION 57 ROTOR CRAFT

No.	Term	Definition
5701	Alpha-one angle	The angle between the blade-span axis, viewed in the plane of rotation from the blade trailing edge, and the laghinge axis.
5702	Blade azimuth angle	The angle, in plan view, between the downwind position (or plane of symmetry) and a line passing through the centre of the rotor hub and lag hinge, measured in the direction of rotation.
5703	Blade pitch angle (blade angle)	The acute angle between the line of zero lift of a blade section and the plane of no feathering.
5704	Coning angle	The angle between the longitudinal axis of a blade and the tip-path plane
5705	Delta-three angle	The acute angle between the normal to the blade axis in plan view and the flapping-hinge axis.
5706	Flapping angle	The angle between the blade-span axis and the plane of no feathering. Blade flapping motion is the variation with azimuth angle of the blade flapping angle
5707	Axial flow	The component of the air flow normal to the tip-path plane.
	BLADES	

No.	Term	Definition
5708	Articulated blade	<p>a) A blade connected to the rotor head by flapping, lag and feathering hinges (fully articulated).</p> <p>b) A blade connected to the rotor head by either a flapping or a lag hinge and a feathering hinge.</p>
5709	Blade damper	A device for damping the motion of a rotor blade about the lag hinge.
5710	Blade loading	The thrust of the rotor divided by the total area of the rotor Blades
5711	Rigidly-mounted blade	A blade which has no pivoted connection to the shaft other than a feathering hinge
5712	Disc area	The area of circle described by the tips of the blades
5713	Disc loading	The thrust of the rotor divided by the rotor disc area
5714	Drag link	An adjustable link between each blade and the hub of certain rotors, used to maintain the angular spacing between the blades
5715	Drag stop	A limit stop used in a rotor*to prevent excessive horizontal movement of a blade in azimuth
5716	Equivalent blade chord	The chord of an imaginary rectangular blade of the same tip radius as a non-rectangular blade giving the same torque (or thrust).
5717	Feathering	Variation with azimuth angle of the blade pitch angle about the feathering hinge.
5718	Aping	Angular oscillation of a blade about the flapping hinge
5719	Ground resonance	A mechanical vibration of a rotorcraft on the ground or other surface when the rotor is in operation, caused by coupling between the periodic motion of the rotor and oscillation of the aircraft on its landing wheels
HINGES		
5720	Feathering hinge	A blade pivot, which allows the blade pitch angle to be varied.
5721	Flapping hinge	blade pivot which allows the flapping angle to vary
5722	Delta hinge	A flapping hinge which is obliquely inclined to a plane normal to the axis of the rotor hub
5723	Lag hinge (drag hinge)	blade pivot which allows the blade to be displaced angularly in azimuth.
5724	In-plane oscillation	Angular oscillation of a blade about the lag hinge
5725	Inflow ratio	The ratio of the total velocity of the axial flow through the rotor disc to the rotor tip speed.
5726	No-feathering axis	The axis through the centre of rotation of the rotor with respect to which there is no variation of blade pitch angle with azimuth angle.
5727	Offset ratio	The ratio of the distance of the centre of the flapping or lag hinge from the centre of the rotor hub to the rotor radius.
OPERATING CONDITIONS		

No.	Term	Definition
5728	Autorotation	That condition of flight of a rotorcraft wherein there is free and continuous rotation of the rotor when it is not power driven (<i>see</i> also 4111).
5729	Normal propeller state	The operating condition of a rotor when the rotor thrust is in the opposite direction to the axial flow through and outside the rotor disc area.
5730	Vortex-ring state	The operating condition of a rotor when the axial flow through the rotor disc is in the opposite direction to the axial flow outside the rotor disc area and to the rotor thrust.
5731	Windmill-brake state	The operating condition of a rotor when the rotor thrust and the axial flow through and outside the rotor disc area are all in the same direction.
PITCH CONTROL		
5732	Collective pitch control	A control by which an equal alteration of blade pitch angle is imposed on all the blades independently of their azimuthal position.
5733	Control advance	The phase angle by which the controlled change of cyclic pitch variation is displaced in azimuth from the direction of control-lever displacement
5734	Cyclic pitch control (azimuthal control)	A control by which the blade pitch angle is varied sinusoidally with the blade azimuth position.
5735	Rotor	A system of rotating aerofoils.
5736	Auxiliary rotor (anti-torque rotor, tail rotor)	A rotor, the primary function of which is to counterbalance the torque reaction of the main rotor in a rotorcraft and/or to change the motion of the aircraft about one of the body axes.
5737	Control rotor	A small servo rotor, mounted coaxially with the main rotor on certain helicopters, the displacement of which by the pilot causes the main rotor to be displaced to direct the thrust. By a damping action, the control rotor usually also contributes to the stability of the helicopter
5738	Jet rotor	A rotor driven by jet reaction devices mounted within or upon the rotor blades, usually at the tips.
5739	Main rotor	A rotor, the primary function of which is to provide lift
5740	See-saw rotor (teetering rotor)	A rotor system, usually of two blades, wherein the blades are attached rigidly to a central head which is in turn attached flexibly (that is, by gimbals) to the rotor shaft.
5741	Rotor head	The entire rotor assembly less the rotor blades.
5742	Rotor hub	The central rotating member of the rotor head which carries the blade arms and hinge assemblies.
5743	Rotor radius	The distance of the blade tip from the centre of the rotor hub for zero lag angle and zero or built-in coning angle.
5744	Solidity	The ratio of the total blade area of a rotor to the disc area
5745	Tip speed	The mean angular velocity of the rotor multiplied by the rotor radius.

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No.	Term	Definition
5746	Tip-speed ratio (advance ratio)	The ratio of the component of the aircraft's forward speed in the no-feathering plane (or tip-path plane) to the rotor tip speed. This is approximately equivalent to the ratio of the velocity of the rotorcraft along the flight path to the rotor tip speed.
5747	Tip-path plane	The plane substantially containing the path described by the blade tips as they rotate.

ANNEX A
(Foreword)

COMMITTEE COMPOSITION

AIR AND SPACE VEHICLES SECTIONAL COMMITTEE SECTIONAL COMMITTEE, TED 14

<i>Organization</i>	<i>Representative(s)</i>
IN Personal Capacity	SHRI DILIP B BHATT (<i>Chairman</i>)
Adani Aerospace and Defence Limited, Bengaluru	SHRI SAMPATHKUMARAN S T
Aeronautical Development Agency, Bengaluru	SHRI D K P SINHA SHRI RAMMOHAN V KAKI (<i>Alternate</i>)
Aeronautical Development Establishment, Bengaluru	SHRI A VAMSIKRISHNA SHRI RANJITH T (<i>Alternate</i>)
Air India, New Delhi	SHRI MATHEW PANICKER
Airports Authority of India, New Delhi	SHRI D DILIP KUMAR
Bharat Dynamics Limited, Hyderabad	SHRI J K MISHRA SHRI KV SUBBA REDDY (<i>Alternate</i>)
CSIR - National Aerospace Laboratories, Bengaluru	SHRI VEERA SESA KUMAR SHRI S RAVISHANKAR (<i>Alternate</i>) DR. SAPTHAGIRI G (<i>Alternate</i>)
Centre for Military Air worthiness and Certification, Bengaluru	SHRI P JAYAPAL SHRI R KAMALAKANNAN (<i>Alternate</i>)
Defence Research and Development Organization, Research Centre Imarat, Hyderabad	DR. S KARUNANIDHI SHRI SSSBS SUBBA RAO (<i>Alternate</i>)
Department of Defence Production, Ministry of Defence, New Delhi	SHRI ARINDAM CHAUDHARY
Directorate General of Aeronautical Quality Assurance, Ministry of Defence, New Delhi	SHRI SANJAY KUMAR SHARMA SHRI MUKESH CHAND MEENA (<i>Alternate</i>)
Directorate General of Civil Aviation, New Delhi	SHRI BHARAT LAL SHRI VEERENDRA KUMAR KABIR (<i>Alternate</i>) SHRI ASEEM KUMAR
Directorate of Naval Air Material, Ministry of Defence	SHRI D D DARKE SHRI R RAJESH (<i>Alternate</i>)

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<i>Organization</i>	<i>Representative(s)</i>
GAIL (India) Limited, New Delhi	SHRI KAUSHIK DAS
Gas Turbine Research Establishment, Bengaluru	SHRI G DEVEANANDA SHRI D NAGARAJU (<i>Alternate</i>)
Godrej Aerospace, Mumbai	SHRI AMOL BANSI THORAT
HQ Maintenance Command, Indian Air Force	SHRI F J D'SOUJA SHRI V. K. GOEL (<i>Alternate</i>)
Hindustan Aeronautics Limited, Bengaluru	SHRI PRATAP PANDA SHRI SUSHIL KUMAR (<i>Alternate</i>)
Indian Institute of Science, Bengaluru	DR. SATISH L. DR. L. UMANAND (<i>Alternate</i>) DR. SUBBA REDDY B (<i>Alternate</i>)
Indian Institute of Technology Madras, Chennai	PROF. HARISHANKAR RAMCHANDRAN
Indian National Space Promotion and Authorisation Centre (IN-SPACE), Ahmedabad	SHRI PARAGJYOTI GARG
Indian Space Research Organization - U R Rao Satellite Centre, Bengaluru	SHRI RAGHAVENDRA KULKARNI SHRI RAYAN KUTTY P P (<i>Alternate</i>)
Indian Space Research Organization - Vikram Sarabhai Space Centre, Thiruvananthapuram	SHRI P. RAMKUMAR SHRI JAYAKUMAR M SHRI GOVIND (<i>Alternate</i>)
Indian Space Research Organization, Bengaluru	DR. A K ANIL KUMAR SHRI MANISH SAXENA (<i>Alternate</i>)
Larsen and Toubro Limited, Mumbai	SHRI LAXMESH B.H. SHRI JAMBUNATHAN G (<i>Alternate</i>)
Society of Indian Aerospace Technologies and Industries, Bengaluru	SHRI FRANCIS XAVIER
Sundram Fasteners Limited, Chennai	SHRI ATUL KUMAR AGRAWAL
In personal capacity	SHRI MANOHAR SIDANA
In personal capacity	SHRI S C SHRIMALI
BIS Directorate General	SHRI P.V. SRIKANTH, SCIENTIST 'D' & HEAD (TED) [REPRESENTING DIRECTOR GENERAL (EX-OFFICIO)]

MEMBER SECRETARY
MR. SHIVAM AGGARWAL
SCIENTIST C / DEPUTY DIRECTOR
(TRANSPORT ENGINEERING DEPARTMENT)