

**APPENDIX 'B'**

**AVIATION METEOROLOGY**

**The syllabus of Aviation Meteorology is as follows:**

**1. Aviation Meteorology**

**1.1 The Atmosphere**

- a) Composition, extent, vertical division
- b) Temperature
  - vertical distribution of temperature
  - transfer of heat : solar and terrestrial radiation, conduction, convection, advection and turbulence
  - lapse rate, stability and instability
  - development of inversions, types of inversions
  - temperature near the earth's surface, surface effects, diurnal
  - variation, effect of clouds, effect of wind
- c) Atmospheric pressure
  - barometric pressure, isobars
  - pressure variation with height, contours (isohypses)
  - reduction of pressure to mean sea level, QFF
  - surface low/upper-air low, surface high/upper-air high-precipitation
- d) Atmospheric density: interrelationship of pressure, temperature and density
- e) International Standard Atmosphere (ISA)
- f) Altimetry
  - pressure altitude, true altitude
  - height, altitude, flight level
  - altimeter settings: QNH, QFE, 1013.25 hPa
  - calculation of terrain clearance, lowest usable flight level, rule of thumb for temperature and pressure influences
  - effect of accelerated airflow due to topography

**1.2 Wind**

- a) Definition and measurement
- b) Primary cause of wind
  - primary cause of wind, pressure gradient, coriolis force

- gradient wind
- relationship between isobars and wind
- effects of convergence and divergence
- c) General circulation
  - general circulation around the globe
- d) Turbulence
  - Turbulence and gustiness, types of turbulence
  - origin and location of turbulence
- e) Variation of wind with height
  - variation of wind in the friction layer
  - variation of the wind caused by fronts
- f) Local winds: Anabatic and katabatic winds, land and sea breezes, venturi effects
- g) Jet Streams
  - origin of jet streams
  - description and location of jet streams
  - names, heights and seasonal occurrence of jet streams
  - jet stream recognition
  - CAT: cause, location and forecasting
- h) Standing waves: Origin of standing waves

### **1.3 Thermodynamics**

- a) Humidity
  - water vapour in the atmosphere
  - temperature/dew point, mixing ratio, relative humidity
- b) Change of state of aggregation: condensation, evaporation, sublimation, freezing and melting, latent heat
- c) Adiabatic processes

## **1.4 Clouds and Fog**

- a) Clouds formation and description
  - cooling by adiabatic expansion and by advection
  - cloud types, cloud classification
  - influence of inversions on cloud development
  - flying conditions in each cloud type
- b) Fog, mist, haze
  - radiation fog
  - advection fog
  - steaming fog
  - frontal fog
  - orographic fog

## **1.5 Precipitation**

- a) Development of precipitation
  - development of precipitation
  - types of precipitation
  - type of precipitation, relationship with cloud types

## **1.6 Air masses and Fronts**

- a) Types of air masses
  - description, factors, affecting the properties of an air mass
  - classification of air masses, modifications of air masses, areas of origin
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- b) Fronts
  - boundaries between air masses (fronts), general situation, geographic differentiation
  - warm front, associated clouds and weather
  - cold front, associated clouds and weather
  - Warm sector, associated clouds and weather
  - weather behind the cold front
  - occlusions, associated clouds and weather
  - stationary front, associated clouds and weather
  - movement of fronts and pressure systems, life cycle

**1.7 Pressure Systems**

- a) Location of the principal pressure areas
- b) Anticyclone: Anticyclones, types, general properties, cold and warm anticyclones, ridges and wedges, subsidence
- c) Non frontal depressions
  - thermal, orographic – and secondary depressions, cold air pools, trough
- d) Tropical revolving storms
  - development of tropical revolving storms
  - origin and local names, location and period of occurrence

**1.8 Climatology**

- a) Climatic zones
  - general seasonal circulation in the troposphere and lower stratosphere
  - tropical rain climate, dry climate, mid-latitude-climate, sub-arctical climate with cold winter, snow climate
- b) Indian Climatology
- c) Tropical climatology
  - cause and development of tropical showers: humidity, temperature, tropopause
  - seasonal variations of weather and wind, typical synoptic situation
  - inter Tropical convergence zones (ITCZ), weather in the ITCZ, general seasonal movement
  - climatic elements relative to the area (monsoon, trade winds, sand storms, cold air outbreaks)
  - easterly waves
- d) Typical weather situations in mid-latitudes
  - westerly waves
  - high pressure area
  - uniform pressure pattern
- e) Local seasonal weather and wind
  - local seasonal weather and wind
  - monsoon (South West and North East), pre-monsoon, post monsoon, northwesterns, kal-baisakhis, western disturbance, Loo.
  - foehn, mistral, bora bora, scirocco
  - khamsin, harmattan, ghibbli and pampero

## **1.9 Flight Hazards**

- a) Icing
  - weather conditions for ice accretion, topographical effects
  - types of ice accretion
  - hazards of ice accretion, avoidance
- b) Turbulence
  - effects on flight, avoidance
  - CAT: effects on flight
- c) Windshear
  - definition of windshear
  - weather conditions for windshear
  - effects on flight
- d) Thunderstorms
  - structure of thunderstorms, squall lines, life history, storm cells, electricity in the atmosphere, static charges
  - conditions for and process of development, forecast, location, type specification
  - Thunderstorm avoidance, ground/airborne radar, storm scope
  - development and effect of down bursts
  - development of lightning discharge and effect of lightning strike on aircraft and flight execution
- e) Tornadoes
- f) Low and high level inversions: Influence on aircraft performance
- g) Stratospheric conditions
  - tropopause influence on aircraft performance
  - effect of ozone, radioactivity
- h) Hazards in mountainous areas
  - influence of terrain on clouds and precipitation, frontal passage
  - vertical movements, mountain waves, windshear, turbulence, ice accretion
  - development and effect of valley inversions
- i) Visibility reducing phenomena
  - reduction of visibility caused by mist, smoke, dust, sand and precipitation

- reduction of visibility caused by low drifting and blowing snow

### **1.10. Meteorological Information**

#### **a) Observation**

- on the ground – surface wind, visibility and runway visual range, transmissometers; Clouds – type, amount, height of base and tops, movement; Weather – including all types of precipitation, air temperature, relative humidity, dew point, atmospheric pressure
- upper air observations
- satellite observations, interpretation
- weather radar observations ground and airborne, interpretation
- aircraft observations and reporting, data link systems, PIREPS

#### **b) Weather Charts**

- significant weather charts
- surface charts
- upper air charts
- symbols and signs on analysed and prognostic charts

#### **c) Information for Flight Planning**

- aeronautical codes: METAR, TAF, SPECI, SIGMET, SNOWTAM, runway report
- meteorological broadcasts for aviation: VOLMET, ATIS, HFVOLMET, ACARS
- content and use of pre-flight meteorological documents
- meteorological briefing and advice
- measuring and warning systems for low level windshear
- inversion
- special meteorological warnings
- information for computer flight planning