4.4. CONTENT OF THE TRAINING PROGRAMME(S) OFFERED INCLUDING THE COURSEWARE AND EQUIPMENT USED

 AERODROME CONTROL COURSE

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| MODULE 1 (Theory) |
| 1. Air Law: The provisions of the Aircraft Rules 1937, Civil Aviation Requirements and any other circulars or instructions relevant to the air traffic control |
| Air Regulation  The Aircraft Act-1934, The Aircraft Rules-1937, The aircraft (Public Health) rules-1954, The Indian aircraft rules-1920, rules as to aircraft arriving in or departing from India, The anti-hijacking act-2016, The suppression of unlawful acts against safety of civil aviation act-1982, Aircraft (Investigation of accidents and incidents) rules-2017, The Aircraft (Demolition of obstructions caused by Buildings and Trees etc.) Rules-1994, The Aircraft (Carriage of Dangerous Goods) Rules-2003, Civil Aviation Requirements, Various circulars relevant to Air Traffic Control  Aviation Security  Importance of Civil Aviation Security, Civil Aviation Security set-up in India, Role of Security agencies in India, Minimum Security Standards, Pre-embarkation Screening, Use of Electronic detection devices, Role of Airport Management to security, Contingency Planning, Procedures for Unlawful Interference Contingency, Bomb Threat call/Warning contingency |
| 2. Air Traffic Control Equipment: Principles, use and limitations of equipment used in air traffic control |
| ATC Equipment  Principles, use and limitations of   * Automatic Dependent Surveillance (ADS) * Multilateration (MLAT) * Advanced Surface Movement Guidance and Control System (A-SMGCS) * Database, Data-Interchange and Automatic Information Systems: * Surveillance Data Processing & Display System (SDPDS), FDPS, Computers, AIDB system, ATIS, AMSS, OLDI, FANS 1/A & CPDLC, CPDLC vs ADS-C * Voice Communication System (VCS) * Other ATC Equipment: Aeronautical Fixed Telecommunication Network (AFTN), Common Equipment in a controller working position (Flight Progress Board, Telephone, Relevant Maps and Charts, Strip Printer, Tele- printers, Digital Clock, Monitors), Other Equipment in Aerodrome Control Tower/Approach/Area Control Centre (Wind indicator, Crash Alarm, Signaling lamp, Lighting control panel, Runway- |

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| in use indicator, Binoculars, Signaling/ flare gun, IRVR, Transmissometer, Aerodrome beacon), SELCAL  Navigational Aids  Radio Wave Theory & Radio Wave Propagation: Radio waves, Radio wave propagation, Frequency Bands, Radio Communication Systems, Antenna, Shadowing.  Navigational Aids: Introduction, Classification of radio navigation aids, Range, Accuracy and Error(Permissible)  Principles, use and limitations of   * Non- Directional Beacon (NDB) * Very High Frequency Omni-Range (VOR) * Distance Measuring Equipment (DME) * Instrument Landing System (ILS) * Radar * Future Air Navigation Systems, ACARS |
| 3. General Knowledge: Principles of flight, principles of operation and functioning of aircraft, engines and systems, aircraft performances relevant to air traffic control |
| Aircraft Operations  Principles of Flight  Introduction to Aircraft: Definitions, Material of aircraft construction, Components of an aeroplane  Principles of Flight: Terminology, Aerofoil, Terms used with Aerofoil, Characteristics of an aerofoil, Lift generation by an aerofoil, Critical angle  Principles of Operation and Functioning of Aircraft  Basic Manoeuvres of Aircraft: Different phases of flight, Forces on aircraft, Basic manoeuvres of an aircraft, Axes of an aeroplane, Factors affecting the lift and drag  Aircraft Stability: Stability, Longitudinal stability, Lateral stability, Directional stability  High Speed Flight: Speed of an aircraft, Speed of sound, Shock waves and shock stall, Mach number and critical Mach number, The sonic barrier  Helicopter: Introduction, Principle of flight, Other Terminology, Helicopter Lift, Helicopter Speed, Helicopter controls, Autorotation  Principles of Operation and Functioning of Engines  Aero Engines: Types of Engines, Difference between engines, Piston engines, Jet engines, Jet engine types and application, Fuel system, Oil system  Propeller: Parts of the Propeller, Propeller blade construction, Types of |



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| propeller, Constant Speed Propellers, Feathering, Reversing, Forces and stresses acting on a propeller in flight, Propeller control  Principles of Operation and Functioning of Systems  Ancillary Systems: Hydraulic system, Various Components Used in Hydraulic System, Retractable under-carriage, Pneumatic system, Aircraft electrical system, Auxiliary Power Unit, Ground Power Unit  Aircraft Instruments: Introduction, Avionics, Systems/subsystems/instruments that are monitored through the aircraft instrumentation, Engine instruments, Gyroscopic instruments, Autopilot, ATC transponder, Communication gear, Direction finding equipment, Navigation devices, Landing aid, Weather radar, Radio altimeter, TCAS, Flight Recorders, Emergency locating transmitter (ELT), Fuel management system, Hazard warning indications, Ground Proximity Warning System, Other instruments  Aircraft Performances Relevant to Air Traffic Control  Aircraft Performance: Torque effect, Absolute Ceiling, Service Ceiling, Best Rate of Climb, Best Angle of Climb, Normal Climb, Gliding Angle, Factors affecting aircraft performance  Aircraft Icing: Effect of icing on aircraft operations, Anti-icing, De-icing  Aircraft Emergencies: Abandoned take off, Engine failure on take-off, Precautionary landing, Priority landing, Engine failure, Emergency landing, Pressurization failure, Hydraulic failure, Landing gear problems |
| 4. Human Performance: Human performance relevant to air traffic control including principles of threat and error management |
| Human Performance relevant to ATC  Fundamental Human Factors concepts: The meaning of human factors, The disciplines of human factors, A conceptual model of human factors, SHEL concept  The Human Element (Aviation Physiology):The air traffic controller, Sleep disturbance, Circadian Dysrhythmia, night shift paralysis, handling traffic peaks at the end of a long shift, Use of breaks, social aspects of shift work  The Human Element (Aviation Psychology): Introduction, human error and human reliability, human information processing, Attitudina    Team Resource Management.  Principles of Threat and Error Management  Threat and Error Management: Introduction, TEM Framework, The Components of TEM framework (ATC), Threats in ATC, Errors in ATC, Undesired states in ATC, Managing Threats and Errors. Case studies of TEM based analysis of actual ATC situations. |

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| 5. Meteorology: Aeronautical meteorology, use and appreciation of meteorological documentation and information, origin and characteristic of weather phenomena affecting flight operations and safety, altimetry |
| Aeronautical Meteorology  Meteorology and Aviation: Introduction, Atmosphere, Composition of the Atmosphere.  Use and Appreciation of meteorological documentation and information  Aviation Met Messages and satellite/DWR imageries: Introduction, METAR, SPECI, Criteria for issuing SPECI, Code format, Time of issue, Dissemination, Code form, TAF, ROFOR, SIGMET, AIREP, Airfield warnings for parked and moored aircraft, Satellite & Weather Radar meteorological imageries, Weather radar.  Aviation Meteorological Organizations in India: Types of MET offices, Functions of MET offices, Services Rendered to Operators/ Pilots/ Air Traffic Service Units.  Origin and Characteristics of weather phenomena affecting flight operation and safety  Temperature: Introduction, Adiabatic Processes, Importance of Air Temperature in Aviation.  Clouds: Introduction, Formation of Clouds, Method of Cloud Dissipation, Significance of Clouds to Aircrew and Aviation, Precipitation.  Thunderstorms: Introduction, Thunderstorms and Aviation, Thunderstorm Weather, Tornado, Formation of Snow, Formation of Hail, Downburst and Microburst/Macroburst.  Wind: Introduction, Pressure and Wind, Variation of Wind with Height, Frictional Effects, Significance of winds in aviation, Local Winds, Vertical motion: Mountain Waves.  Visibility: Introduction, RVR, Meteorological Phenomenon Affecting Visibility.  Jet stream: Introduction, Description, Relation between Jet Stream and Tropopause, CAT and Jet Streams.  Ice Accretion on Aircraft: Introduction, Defects of Icing on Aircraft Performance, Engine Icing, Types of Icing, Hints on Flying in Icing Regions.  Atmospheric Turbulence: Introduction, Mechanical Turbulence, Thermal Turbulence, Turbulence and Aviation, Turbulence within Cumuliform Clouds, Turbulence in the vicinity of Mountains, Artificially Induced Turbulence, CAT.  Synoptic Meteorology: Definitions and short notes, explanatory notes regarding climate of India.  Altimetry  Atmospheric Pressure: Introduction, Standard atmosphere, Altimeter settings. |

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| 6. Navigation: Principles of air navigation, principles, limitation and accuracy of navigation systems and visual aids |
| Air Navigation  Principles of Air Navigation  Form of the earth, measurement of distance on the surface of the earth, measurement of directions, Time, D R navigation  Principles, limitation and accuracy of Navigation Systems   * Magnetism & compass * GYRO Based instruments * Pitot Static Instruments * Automatic Direction Finder (ADF) * VHF Omni-directional Radio Range (VOR) * Distance Measuring Equipment * Instrument Landing System (ILS) * Satellite Navigation   Aerodrome and Ground Aids  Aerodrome-Introduction, Aerodrome Data, Physical characteristics of Runways and associated areas, Physical characteristics of Taxiways and associated areas, Obstacle Restriction and Removal  Principles, limitation and accuracy of Visual Aids   * Markings on Runways, Taxiways and Apron, * Signs and Indicators, * Visual aids for denoting restricted use of areas, visual aids for denoting obstacles. * Visual Aids: Runway lighting system, Taxiway lighting System, Approach lighting system, Visual Approach Slope Indicator systems, Limitations of visual aids. |
| 7. Operational Procedures: Air traffic control, communication, radio- telephony and phraseology procedure (routine, non-routine and emergency), use of relevant aeronautical documentation, safety practices associated with flight |
| Air Traffic Control  Air Traffic Services-Theory  Air Space Organization: Definitions, Establishment of authority, Determination of the need for ATS, designation of the portions of the airspace and controlled aerodromes where ATS will be provided, |

Classification of airspaces, establishment and identification of ATS routes, composition of designator, airspace restrictions and reservations, Temporary restricted areas effecting ATS routes/controlled airspaces, Special designated airspace.

Air Traffic Services: Definitions, Objectives of the Air Traffic Services, Divisions of the air traffic services, Application, Establishment and designation of the units providing air traffic services, Provision of air traffic control service, identification of air traffic services units and airspaces, Operation of air traffic control service, Separation minima, Responsibility for control, Transfer of responsibility for control, Air traffic control clearances, Time in air traffic services, Common reference systems, Contingency arrangements, Voice-Automatic terminal information service (Voice-ATIS) broadcasts, Data link-Automatic terminal information service (D- ATIS), Automatic terminal information service (Voice and/or Data link), ATIS for arriving and departing aircraft.

Aerodrome Control Service: Definitions, Functions of Aerodrome control towers, Selection of Runway-in-use, Initial call to Aerodrome control tower, Start-up time procedures, Aerodrome and Meteorological information, Essential local traffic information, Runway incursion or obstructed runway, Uncertainty of position on the Manoeuvring area, Wake turbulence and jet blast hazards, Abnormal aircraft configuration and condition, Essential information on aerodrome conditions, Control of Aerodrome traffic, Traffic on the manoeuvring area, Control of persons and vehicles at aerodromes, Communication requirements and Visual signals, Control of traffic in the Traffic circuit, Control of arriving aircraft, Procedures for low visibility operations, Use of SMR, Aeronautical ground lights, Designation of hot spots, Wind shear advisories, Prevention of safety occurrences during RWY inspection, Reduction in separation minima in the vicinity of aerodromes.

Rules of the Air (General Rules): Definitions, Territorial application of the rules of the air, Compliance with the rules of the air, Responsibility for compliance with the rules of the air, Authority of pilot-in- command of an aircraft, General rules, When an aircraft is used for acrobatics, Unmanned free balloons, Prohibited areas and restricted areas, Avoidance of collisions, Lights to be displayed by aircraft, Lights to be displayed by Aero planes, Simulated instrument flights, Operation on and in the vicinity of an aerodrome, Flight Plan, Signals, VMC visibility and distance from cloud minima.

Rules of the Air (Flight rules): Definitions, Visual Flight Rules, Instrument Flight Rules, System of cruising levels (applicable in India).

Coordination in respect of the provision of Air traffic control service: Definitions, General, Coordination between a unit providing Area control service and a unit providing Approach control service, Coordination between a unit providing Approach control service and a unit providing Aerodrome control service, Coordination between control positions within the same unit, Coordination in respect of the provision of flight information service and alerting service, Coordination between the Operator and Air traffic services, Coordination between Military authorities and Air traffic services, Coordination of activities potentially hazardous to civil aircraft, Coordination between Meteorological and Air traffic services authorities, Coordination between Aeronautical information services and Air traffic services authorities.

Wake Turbulence: Definitions, Introduction, Separation Minima, Effects on aircraft, Categorization of aircraft, Minima related to conditions, Cautionaries, Jet blast, minimizing the effect of Wake turbulence, Indication of heavy wake turbulence category.

Signals: Definitions, Signals, Distress and urgency signals, Signals for use in the event of interception, Visual signals used to warn an unauthorized aircraft flying in or about to enter a restricted, prohibited or danger area, Signals for aerodrome traffic.

Flight Plan: Definitions, A flight plan, Flight plan form, Contents of a Flight plan, Completion of a Flight plan, Acceptance of a Flight plan, Adherence to Flight plan, Changes to a Flight plan, Closing a Flight plan, Flight planning: notification of flight (applicable in India), Use of Repetitive Flight plans (RPLs), ICAO model Flight plan form, Instructions for the completion of the flight plan form.

Altimeter setting procedures: Definitions, Introduction, Transition altitude, Transition level, Altimeter setting procedures, Take off and climb, vertical separation En-route, Approach and landing, Missed approach, Procedures applicable to operators (including pilots), Minimum flight altitude, System of cruising level, Changing levels, Terrain clearance, Altimeter setting procedures applicable to ATS and minimum levels, Expression of vertical position of aircraft, Minimum cruising level for IFR flights, Provision of altimeter setting information.

Aerodrome Operating Minima: Aerodrome Operating Minima, in-flight procedures, Alternate aerodromes, Weather conditions.

ATS Messages: Definitions, categories of messages, Transmission of ATS messages via AFTN, composition and examples of ATS messages.

Communication Radio-Telephony and phraseology procedure (routine, non-routine and emergency)

RT Procedure

General Operating Procedures: Introduction, RTF Transmitting technique, Transmission of letters, numbers, time and frequency, ICAO Phonetics, Standard Words and Phrases, Call Signs for Aeronautical Stations, Call Sign for Aircraft stations, ICAO Airline Designator, ICAO Location designator.

RTF communication Procedures: RTF test procedures, Establishment and Condition of Communications, Transfer of Communications, Use of plain language in RTF communication, Issue of Clearance and Read-Back in RTF, Simultaneous/blocked transmission.

Distress, Urgency and communication failure Procedures: General, Distress Messages, Urgency Messages, imposition of silence, Termination of distress and RTF silence, Emergency descend, Fuel shortage, RCF.

General Phraseology, Miscellaneous flight handling phraseology. Miscellaneous Topics: NOTAM, Licensing Requirements.

Use of Relevant Aeronautical Documentation

Aeronautical Information Services

General: Introduction, Definitions, Objective of AIS, Common reference systems for air navigation, Miscellaneous Specification, Basic Reference Material

Responsibilities and Functions: State Responsibilities, AIS Responsibilities and Functions, Exchange of aeronautical data and aeronautical information, Copyright, Data quality specifications, Aeronautical data and aeronautical information verification and validation, Use of Automation, Quality management system, Scope of aeronautical data and aeronautical information.

Aeronautical Information Services in India: Responsible service, AIS Headquarters, International NOTAM Office, Area of responsibility, Aeronautical Publications, Post-flight information, AIRAC system.

AIS setup in India: AIS setup in India, Aeronautical information flow diagram, Aeronautical information Users, Aeronautical information Sources.

Aeronautical Information Publication: General Specifications of eAIP, Statements, AIP updates, AIP Supplements, Aeronautical Charts, Distribution, Contents of AIP.

NOTAM: Origination, Duration of NOTAM, General Specifications, Methods of Distribution of NOTAM, Instructions for the completion of the NOTAM Format, Promulgation of NOTAM in Series

Transition from AIS to AIM: Description

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| Safety Practices associated with Flight  Rescue and Fire- fighting services  Rescue and Fire Fighting Services: Chemistry of fire, extinguishing media and equipment, Aircraft fire hazards and Air crash, Airport emergency Planning, Natural/National disaster mitigation plan - role of ATC, Airport Category, Airport Fire Services.  Safety Management System  Safety Management System: Definitions, Introduction, ICAO requirements, AAI Safety Policy and Safety Objectives, The Concept of Safety, A Concept of Accident Causation and the Organization Accident, Errors and Violations, Safety Management - Eight Building Blocks, Understanding Hazards and Identifications, Safety Risk and Mitigation, Change Management |
| MODULE 2 (Practical Simulation) |
| Cambay Aerodrome General:  The practical exercises are designed for an imaginary aerodrome named    controlled airspaces and equipped with appropriate radio navigational aids. Cambay is an International Airport served by two runways crossing each other. All types of aircraft including A-380 can operate from Cambay. Fully equipped air traffic control facilities such as Control tower, Approach control and Area control centre using latest Radar system ensures safe, expeditious and efficient flow of all arriving and departing aircraft from Cambay.  The airport environment of Cambay international airport is utilized in providing comprehensive training in ATC, both in procedural as well as surveillance control to the trainee controllers in a simulated environment. |
| 1. Radio Telephony Procedures Simulation |
| Simulator Training (on synthetic R/T circuit)  Simulators: The exercises are simulated in Procedural Simulator. |

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| During Practical Training, use of standard phraseologies for handling traffic and effecting co-ordination procedures (during normal situation as well as during unusual occurrences) are emphasized. |
| 2. Surface Movement Control Simulation |
| Apron Control and Surface Movement Control  Pre-conditions for simulation at Cambay, Cambay lay out, Jurisdiction of Apron control and Ground, Taking over watch, Obstructions at Cambay, Loss of communication with inspection vehicle, Coordination procedure, Inspection of movement Area, Predetermined positions, Cooling pit, Fire pit, Staging area, Rendezvous point, Timings for simulation, Pre-exercise checks, Planning before the commencement of exercise, Flight Progress Strip marking.  Simulator Training  Topics for simulation:  Handling of aircraft movement and vehicular movement in movement area of the aerodrome Push back/ start up clearances, Taxing / Towing clearances, Instructions for safety and other vehicles, Handling Normal traffic with conflicts, Handling unusual traffic, Co- ordination with other ATC units and Strip marking. |
| 3. Aerodrome Control Simulation |
| Simulator Training  Aerodrome Control Practices and Procedures at Cambay General:  Pre-conditions for Simulation at Cambay, Cambay lay out, Jurisdiction of Cambay Tower, Taking Over Watch, ATS Route, Obstructions at Cambay, Cambay Approach Control Jurisdiction, Mandatory Position Reports by an Aircraft, Loss of Communication with Inspection vehicle, Coordination Procedure, Inspection of Movement Area, Local Flying, Fuel Dumping Area, Predetermined Position for Aircraft, Cooling Pit, Fire Pit, Staging Area, Rendezvous Point, Timings for Simulation, Pre Exercise Checks, Planning before the Commencement of Exercise.  Aerodrome Control Simulation: |

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| Objective: Use Standard Phraseology and Strip Marking Procedures, Expedite Arrivals and Departures, Manage arrival Sequence, Effect coordination Procedures, Handle Normal & unusual occurrences while providing Aerodrome Control Service.  Simulator Training Briefing: In addition to the topics covered during SMC briefing, the following topics are covered.  Airspace Classification at Cambay, Functions of Tower, conditions for simulation, Aerodrome Traffic circuit, Traffic resolution, Flight Progress strip marking, Coordination, Phraseologies.  Simulator Training scenarios:  Normal Traffic handling; Normal traffic handling arrival/ departure, Normal traffic with conflicts. Conflicts detection and resolution, Co-ordination with other ATC units, Strip marking.  Unusual Occurrences: Missed Approach, Runway Blockage, Priority Handling, Aerodrome Warning, Radio Communication Failure, Bomb Threat, Distress Handling, Aircraft Accident, Landing Gears Malfunction. |
| SIMULATION EXERCISES AND BRIEFING |
| Each trainee does 15 exercises (03 exercises RT Procedures + 03 exercises SMC + 09 exercises ADC) and monitors the exercises of other trainees in the batch.  1) RT Procedures Simulation  Each participant does three exercises of RT Procedures for approximately 20- 25 minutes duration each. In addition, S/he gets the opportunity to monitor the exercises of the fellow trainees in the batch.  Total number of simulator Exercises 03 One batch comprises of 12 trainees Total time required 14 hours  Objective of Different Exercises of RT Procedures Simulation Exercises:  Exercise No. 1  Transmission Techniques, Pronunciation of numbers and alphabets, Pronunciation of Altitude, Flight Levels, Visibility, RVR, Temperature, QNH and Time, Pronunciation of Call Signs, ICAO Airline Designators, ICAO Location Indicators, ATS routes.  Exercise No. 2  Objective of Exercise No.1 + Transmission of METAR on RT, establishment and condition of communications, Test procedures, Issue of clearance and |

read-back, Transfer of communications Exercise No. 3

Objective of Exercise No.2 + Pre-exercise checks, use of standard phrases and phraseologies in normal as well as emergency situations, Coordination between different units

2) Surface Movement Control Simulation

Theory (briefing) 05 hours

Each participant does three exercises of Surface Movement Control for approximately 50 (35 min exercise + 15 min discussion) minutes duration each. In addition, S/he gets the opportunity to monitor the exercises of the fellow trainees in the batch.

Total number of simulator exercises 03\* One batch comprises of 12 trainees Total time required 35 hours

Objective of Different Exercises of SMC Simulation Exercises:

Exercise No. 1

Pre-exercise checks, Use of proper RT technique, Operational area inspection, Instruction/information for vehicular traffic, Instruction/information for towing and departing aircraft using standard phraseology, Bay allotment, FPS marking and Co-ordination etc.

Exercise No. 2

Objective of Exercise number 1 + Use of SMGCS, Coordinating and framing ATC clearance, Instructions for arriving aircraft, resolving conflicts etc.

Exercise No. 3

Objective of Exercise number 2 + Handling unusual situations.

Aerodrome Control Simulation

Theory (briefing normal traffic + unusual situation) 18 hours

Each participant does 09 exercise of Aerodrome Control for approximately 30-

40 minutes duration and thereafter discussion by the instructors with the trainees for 15-25 minutes (Approx).

In addition, S/he gets the opportunity to monitor the exercises of the fellow trainees in the batch.

Total number of simulator Exercises 09\* One batch comprises of 12 trainees

Total time required (including PT- 03 hrs. & MT- 21 hrs.) 162 hours

Objective of Different Exercises of Aerodrome Control Simulation:

Exercise No. 1

Normal Traffic handling using standard phraseology, FPS marking, Strip/Bay management, Co-ordination, Framing ATC clearance, resolving conflicts etc.

Exercise No. 2

Objective of Exercise number 1 + Local flying.

Exercise No. 3

Objective of Exercise number 2 + RWY incursion/Missed/Unstable approach. Exercise No. 4

Objective of Exercise number 3 + Runway Excursion / Blockage Exercise No. 5

Objective of Exercise number 4 + Aerodrome Warning/Change of Runway/RCF.

Exercise No. 6.

Objective of Exercise number 5 + Priority & Bomb threat. Exercise No. 7

Objective of Exercise number 6 + Distress. Exercise No. 8

Objective of Exercise number 7 + Aircraft Accident. Exercise No. 9

Objective of Exercise number 8 + Misc. unusual occurrence

(\*Out of total exercises, one exercise each in Surface Movement Control Simulation and Aerodrome Control Simulation will be carried out in AVS lab, as far as practicable.)