

Syllabus of Advanced Training in Meteorological Instrumentation & Information System

Theory Paper 3

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Learning Objective		<ol style="list-style-type: none"> 1. Understanding the working principle of various meteorological instruments. 2. To gain knowledge about the basic components of AWS/ARG. 3. To learn fundamental concept of satellite communication and Technological Aspect of Met. Satellite. 4. To understand Ozone and its importance in Meteorology. 			
S.No.	Subject	Module 1	Module 2	Module 3	Module 4
1.	MET Instruments (18P)	<p>Surface Instruments Measurement Principle of – Barograph, thermograph, hair hygograph, pressure tube anemograph, distant indicating wind equipment, Natural siphon recording rain gauge, tipping bucket rain gauge, HWSR.</p> <p>Period Allocated: 5P</p>	<p>Upper Air Instruments: Theory+Practical: Different types of upper air technologies-Radiosonde, GPS radiosonde, LIDAR, Wind Profiler, SODAR, Radiooccultation, Dropsonde, Microwave Radiometer, Ground Equipment. Different types of Horizontal sounding. Inventory control and Accident preventions techniques. Overview of WMO practices and CIMO Guidelines.</p> <p>Period Allocated: 5P</p>	<p>Aviation Instruments Working Principle, Installation, Testing, Maintenance and Calibration - a) Current Weather Instruments System (CWIS)/DCWIS. b) Transmissometer (Single base and Dual base) c) Ceilometer & Ceilograph</p> <p>Signal cables (Armored & Flexible), Short Range Modems, Radio Modems; Frequencies allotment for AMIS. ICAO and WMO regulations on navigational Aids and safety measures. Definition of category of Airports; Criteria for selecting site for installation and Minimum Number of Airport Met. Instruments, Challenges in adverse weather like fog.</p> <p>Period Allocated: 5P</p>	<p>Radiation Instruments Importance of radiation in the study of meteorology. Laws of radiation, units. General principles of radiation and Ozone measuring instruments. Measurement of direct, global, diffuse and reflected solar radiation. Working Principle, Installation, Testing, Maintenance and Calibration- a) Pyranometers b) Pyrhemometers c) Thermoelectric Pyrgeometer d) Pyrradiometer e) Spectrophotometer</p> <p>Period Allocated: 3P</p>
2.	AWS and ARG (10P)	<p>Automatic Weather Stations: Introduction, Installation, Testing and Maintenance of AWS System. Introduction to Agro-AWS, Automatic Rain gauge (ARGs) Stations. Sensors and their characteristics: Types, Different outputs and their characteristics of sensors,</p>	<p>Data Logger and Transmitter: Components and different types, Configuration and operation, troubleshooting procedures, Scheduling the sampling of meteorological parameters. Hand held data loggers. Power Supply: Power requirements, use of battery and solar panel,</p>	<p>AWS Data Format: Study of data format, Generation of station identification code (BCH code), encoding and decoding. Mode of AWS data transmission. Pseudo Random Burst Sequence (PRBS). AWS Data Handling:</p>	<p>Maintenance: Preventive and corrective maintenance of AWS system/ sensors and field calibration.</p> <p>Guidelines for selection of site for an AWS/ARG.</p>

		<p>slope and offset calculations for a linear analog output sensor, Interfacing of different sensors with the logger and Signal conditioning. Calibration Procedures for various sensors.</p> <p>Period Allocated: 4P</p>	<p>testing, installation and maintenance.</p> <p>Antenna: Installation, testing of various types of antenna used in AWS.</p> <p>Period Allocated: 2P</p>	<p>Software for coding and decoding AWS data in WMO format. Application of GIS to AWS data.</p> <p>PCMCIA Card/ Flash Card: Retrieval of AWS data from the field unit.</p> <p>Period Allocated: 2P</p>	<p>Guidelines for construction of civil structures at the site.</p> <p>Period Allocated: 2P</p>
3.	Satellite Communication System (7P)	<p>Introduction: Description of Satellite communication system, Advantages of Satellite Communication over conventional communication techniques, Fundamentals of orbital mechanics relevant to satellite communication, Types of different satellites (LEO, GEO, Polar) and their applications.</p> <p>Period Allocated: 2P</p>	<p>Frequency consideration for satellites, interference, frequency sharing, INSAT communication and Earth Station.</p> <p>Satellite Link Calculation: Calculation of uplink (C/N0) and downlink (C/N0), EIRP, free space losses, Quality objectives of the Satellite link.</p> <p>Period Allocated: 2P</p>	<p>Earth Station: Ground segment, Antenna, LNA, HPA, down converters, Network Manager System (NMS), etc. Ground based GPS receivers for total perceptible water vapour measurements. Reception of Satellite Data at Earth station.</p> <p>Period Allocated: 2P</p>	<p>Practical on Earth Station receiving equipment.</p> <p>Period Allocated: 1P</p>
4.	Meteorological Satellite (10P)	<p>History and development of Met. Satellite with brief details of instruments on board TIROS, ESSA, ITOS (NOAA), Metop and INSAT series of Satellite scanning Radiometer.</p> <p>Brief description of Solar Radiation and Climate Experiment (SORCE), Geostationary Operational Environmental Satellite (GOES) and Polar-orbiting Operational Environmental Satellite (POES).</p> <p>Principle of obtaining cloud imagery and sounding data from Satellite, orbits & perturbations.</p> <p>Data storage and retrieval of Satellite data.</p> <p>Period Allocated: 3P</p>	<p>Commonly deployed sensors on board Satellite with brief description of their functioning, viz.:</p> <ol style="list-style-type: none"> 1)Advanced Very High Resolution Radiometer (AVHRR) 2) Scanning Multichannel Microwave Radiometer (SMMR) 3)Moderate Resolution Imaging Spectroradiometer (MODIS) 4)Atmospheric Infrared Sounder (AIRS) 5)Microwave Imager (MWI) 6)Special Sensor Microwave Imager/Sounder (SSMIS) 7)Visible Infrared Imaging Radiometer Suite (VIIRS) 8)Advanced Microwave Scanning Radiometer 2 (AMSR2) 9)Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) 10)Visible Infrared Imaging Radiometer Suite (VIIRS) 11)Total Ozone Mapping Spectrometer (TOMS) 12)Advanced Scatterometer (ASCAT) <p>Period Allocated: 2P</p>	<p>Technological Aspect of Met. Satellite: INSAT system (VHRR, CCD, DRT, Search and Rescue(SAR)) description of Met. Instruments on board INSAT systems, INSAT-3D,3DR, 3DS (Imager and Sounder).</p> <p>MMDRPS system and details of its various sub-systems for reception and processing of INSAT Data at IMD.</p> <p>Period Allocated: 3P</p>	<p>Practical reception of data in HRPT/Metop.</p> <p>Practical on RAPID website</p> <p>Practical on MMRDPS</p> <p>Period Allocated: 2P</p>
5.	Marine	Requirements, Principles,	Marine meteorological	Global Maritime	

	Meteorological Services (4P)	Procedures, International standards for the dissemination of meteorological information, Areas of responsibility (Metarea and Navarea), Observational networks and data management. Period Allocated: 2P	services for 1) Search & Rescue (SAR) 2) Navigational Warning Period Allocated: 1P	Distress and Safety System (GMDSS)- Introduction, Components. Transmission of GMDSS message over satellite (INMARSAT, IRIDIUM). Period Allocated: 1P	
6.	Radio Regulation (2P)	Radio Regulation: Basic Principle of Radiation relevant to Satellite Meteorology. Period Allocated: 1P	Function of ITU, India's Communication Set up, Frequency allocation, National and International frequency registration, Monitoring Definition of Telecom. Terms w.r.t. International coordinates, Nomenclature of frequency Bands, Interface, Frequency call signs, Designation of emissions, Calculation of Band width, International codes, Distressed condition alarm etc. Period Allocated: 1P		
7.	Ozone and Air Pollution (5P)	OZONE Theory + Practical Ozone and its importance in Meteorology, measurements of total ozone, vertical distribution of ozone and surface ozone, ozone sonde, Dobson and Brewer spectrophotometer. Sensor and Instruments used in IMD for monitoring of Ozone Parameters. Period Allocated: 3P	Air Pollution measurement: AOD, Precipitation chemistry, PH meter, Conductivity meter, SO ₂ / Nox/ TSPM measurement. Sensor and Instruments used in IMD for monitoring of Air Pollution. Period Allocated: 2P		
Learning Outcomes		<ol style="list-style-type: none"> 1. Development of basic skill set for the measurement of various meteorological parameters. 2. To be able to do preventive maintenance of AWS/ARG System and sensors. 3. Understand principle, working and operation of various sub systems of Met. Satellite along with the basics of MMDRPS. 4. To gain knowledge of various parameters of Air Pollution. 			