

**भारत मौसम विज्ञान विभाग**  
**सूचना संचार एवं उपकरण प्रशिक्षण केंद्र, नई दिल्ली**  
**(विश्व मौसम संगठन का क्षेत्रीय प्रशिक्षण केंद्र, नई दिल्ली)**  
**Advance Training Course in Meteorological Instrumentation**  
**&**  
**Information System (Batch No – XII)**

Final Exam: Paper –III

Date: 01.09.2023

Max. Marks -100

Time:- 10:30-13:30

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**Surface Instruments (Total 10 Marks)**

**1. (A) Fill in the blanks: (Answer any 4)**

**(1 × 4 = 4 Marks)**

- i. Duration of bright sunshine is taken into account when direct solar radiation exceeds \_\_\_\_\_  $Wm^{-2}$ .
- ii. Temperature coefficient of expansion of invar used in thermograph is \_\_\_\_\_ compared to bronze/steel.
- iii. Inside diameter of IMD's open pan evaporimeter is \_\_\_\_\_ cm.
- iv. In Stevenson's screen, the bulb of maximum thermometer is generally kept downward at an angle of \_\_\_\_\_ to the horizontal.
- v. Surface temperature generally refers to free air at a height of \_\_\_\_\_ m.
- vi. In hair hygrometer the length of hair used is approximately \_\_\_\_\_

**1. (B) Indicate True or False with justification: (Answer any 3)**

**(2 × 3 = 6 Marks)**

- i. Why mercury is used in thermometer, barometers etc.?
- ii. What exposure conditions should be ensured for setting up an observatory?
- iii. Why maximum thermometer is kept tilted in the Stevenson's screen?
- iv. Why open pan evaporimeter is kept on a white painted wooden platform?

**Aviation Instruments, AWS & ARG (Total 20 Marks)**

**2. (A) Fill in the blanks: (Answer any 5)**

**(2 × 10 = 10 Marks)**

- i. Aviation Site i.e. Met-park shall be within \_\_\_\_\_ m from Central line of runway and shall be within \_\_\_\_\_ mts from runway threshold.
- ii. Visibility Sensors to get MOR & RVR shall be put \_\_\_\_\_ m above ground.
- iii. The wind Cross wind speed is measured at Airport by \_\_\_\_\_ sensor.
- iv. GPRS based AWS is \_\_\_\_\_ way communication.
- v. Real time embedded controller named \_\_\_\_\_ is also used to convert digital signals in Drishti Transmitter.
- vi. The ceilometer functions according to the \_\_\_\_\_ principle.
- vii. \_\_\_\_\_ is used to convert light signals to electrical signals in OFC communication.

**2. (B) Indicate True or False with justification: (Answer any 5)**

**(2 × 5 = 10 Marks)**

- i. Ultrasonic wind sensor requires regular maintenance.
- ii. The resolution of TBRG sensor used in IMD's AWS and ARG is 0.1 mm.
- iii. Agro AWS have soil sensors used for measurement soil temperature and soil moisture.
- iv. The SMF battery of AWS /ARG / Agro AWS is charged by Electrical charger.
- v. The sensing element of Temperature in AT/RH sensors is Pt 100.
- vi. Rain gauge (TBRG) is a digital sensor.
- vii. Ceilometer gives height of base of low cloud which is top of the instrument.

**Satellite Meteorology (Total 50 Marks)**

**3. (A) Fill in the blanks: (Answer any 4)**

**(1 × 4 = 4 Marks)**

- i. \_\_\_\_\_ & \_\_\_\_\_ modulation technique used in Imager and Sounder payloads of INSAT-3D/3DR satellite to receive the signals.
- ii. DRT payload of INSAT-3D satellite is having uplink frequency \_\_\_\_\_ and downlink Frequency \_\_\_\_\_.
- iii. GPS satellites Carries Atomic Clock on board and transmit two low power radio signals, L1= \_\_\_\_\_ and L2 = \_\_\_\_\_.
- iv. \_\_\_\_\_ & \_\_\_\_\_ modulation technique used in Imager and Sounder payloads of INSAT-3D/3DR satellite to receive the signals.
- v. \_\_\_\_\_ hrs. Orbital period of GPS Satellites are in orbit around the earth.
- vi. \_\_\_\_\_ meters diameter antenna is used to receive the data from INSAT-3D/3DR satellite.

**3. (B) Indicate True or False with justification: (Answer any 3)**

**(2 × 3 = 6 Marks)**

- i. The Antenna Control Unit (ACU) is used for steering the antenna either manually or automatically.
- ii. INSAT-3D/3DR is a polar satellite.
- iii. In order to reduce the multipath effects a 5° elevation cut-off angle is fixed.
- iv. When GNSS signal passes through the troposphere, Refractivity associated with changes in electron plasma density or TEC between 50 and 400 km AGL.

**3. (C) Fill in the blanks: (Answer any 4)**

**(1 × 4 = 4 Marks)**

- i. As the height of a satellite orbit increases, the speed of the satellite \_\_\_\_\_
- ii. Transmission delay is maximum in \_\_\_\_\_ Satellite communication system (LEO/GEO/MEO)
- iii. Orbital slots are allocated to the Satellite operator by \_\_\_\_\_
- iv. The value of eccentricity of a satellite orbit lies between \_\_\_\_\_ and \_\_\_\_\_
- v. Kepler's third law states that, the square of the periodic time of an elliptical orbit is proportional to the cube of its \_\_\_\_\_ Axis.

**3. (D) Indicate True or False with justification: (Answer any 3)**

**(2 × 3 = 6 Marks)**

- i. Satellite deviates from its orbit when Centripetal force is equal to the Centrifugal forces. (true/false)
- ii. Ka band is cost effective as compared to X band for satellite communication. (true/false)
- iii. Orbital velocity doesn't depend on the distance from satellite to center of the Earth.

**3. (E) Fill in the blanks: (Answer any 4)**

**(1 × 4 = 4 Marks)**

- i. Orbital period of geostationary satellite is \_\_\_\_\_ Hours.
- ii. The INSAT 3DR satellite is located at \_\_\_\_\_ °E.
- iii. Temperature profile can be derived from INSAT-3DR \_\_\_\_\_
- iv. INSAT 3D is a \_\_\_\_\_ type of satellite.
- v. Noaa-17 is a \_\_\_\_\_ type of satellite.

**3. (F) Indicate True or False with justification: (Answer any 3)**

**(2 × 3 = 6 Marks)**

- i. Electromagnetic radiation exhibit singular nature properties.
- ii. Wien's Displacement Law states that radiation emitted by a black body is a function of wavelength ( $\lambda$ ) and temperature ( $T$ ).
- iii. A polar orbit is an orbit in which a satellite passes above or nearly above the equator.
- iv. ROSA is payload of Metop Satellite.

**3. (G) Fill in the blanks: (Answer any 4)**

**(1 × 4 = 4 Marks)**

- i. IASI stands for \_\_\_\_\_
- ii. The Advanced Microwave Sounding Unit (AMSU), a 20-channel radiometer, provides information on the \_\_\_\_\_ and \_\_\_\_\_ structure of the atmosphere.
- iii. Information on water vapour content can be gained from two water vapour (H<sub>2</sub>O) lines at \_\_\_\_\_ and \_\_\_\_\_ GHz.
- iv. Carbon dioxide (CO<sub>2</sub>) spectral bands at \_\_\_\_\_ and \_\_\_\_\_ microns give us information on the temperature structure of the atmosphere.
- v. In a physical retrieval \_\_\_\_\_ scheme must be used.

**3. (H) Short notes: (Answer any 2)**

**(2 × 3 = 6 Marks)**

- i. Define: Orbit, Swath, escape velocity, payload.
- ii. What are the merits and demerits of Polar orbiting satellite?
- iii. Short Notes on : i) Imager ii) Sounder

**3. (I) Fill in the blanks: (Answer any 4)**

**(1 × 4 = 4 Marks)**

- i. Weighted Mean temperature of the vertical atmosphere  $T_m = 55.8 + 0.77 \times$  \_\_\_\_\_.
- ii. Tropospheric delay = Hydrostatic Delay + \_\_\_\_\_.
- iii. Water vapor channel is sensitive to the \_\_\_\_\_ part of the atmosphere.
- iv. Night time fog is mainly derived using channel differencing techniques using the difference of \_\_\_\_\_ (TIR & MWIR / WV & SWIR).
- v. Temperature profile can be derived from INSAT-3D \_\_\_\_\_.

**3. (J) Indicate True or False with justification: (Answer any 3)**

**(2 × 3 = 6 Marks)**

- i. The value of eccentricity of an elliptical orbit lies between one and two.
- ii. All the processed Satellite images & products are archived on a regular basis.
- iii. Only satellite tools are available to IMD to detect genesis and growth of tropical cyclones.
- iv. A satellite whose orbital plane is inclined close to 45 degrees with respect to earth equatorial plane is called polar orbiting satellite.

### **Radiosonde / Radiowind System (Total Marks - 10)**

#### **4. (A) Choose the correct alternative: (Answer any 4)**

**(1 × 4 = 4 Marks)**

- i. The Intermediate frequency (IF) of RSGE system is \_\_\_\_\_ MHz.
  - a. 10.7 MHz
  - b. 33 MHz
  - c. 68 MHz
- ii. The antenna used in IMS-1500 is of \_\_\_\_\_ Type.
  - a. Co-axial Collinear
  - b. Dish type
  - c. Helical
- iii. Which of the following is not a parameter observed in radio wind observation.
  - a. Temperature
  - b. Wind Direction
  - c. Wind speed
- iv. IMD has a network of \_\_\_\_\_ Stations in its RS/RW upper air network.
  - a. 56
  - b. 62
  - c. 99
- v. The Temperature sensor in GPS based radio-sounding is of
  - a. Bead Type
  - b. Digital IC
  - c. capacitive type
- vi. Which of the IMD station is part of WMO-GUAN network?
  - a. Chennai
  - b. Port Blair
  - c. Srinagar

#### **4. (B) Indicate True or False with justification: (Answer any 3)**

**(2 × 3 = 6 Marks)**

- i. Radio theodolite systems use super-heterodyne type of Receivers,
- ii. Tracking of pilot balloon (PB) in optical theodolites is a fully automatic observation.
- iii. Wind profilers are Doppler radars with limited utility.
- iv. Wind observation in GPS based radio-sounding systems are based on the drift of the balloon in atmosphere.

### **Radio Regulation (Total Marks - 5)**

#### **5. (A) Fill in the blanks: (Answer any 5)**

**(1 × 5 = 5 Marks)**

- i. Radionavigation \_\_\_\_\_.
- ii. International management of the radio-frequency spectrum and satellite orbits is coordinated by \_\_\_\_\_.
- iii. \_\_\_\_\_ are fundamental to the operation of today's ICT networks.
- iv. Latest NFAP was implemented in \_\_\_\_\_.
- v. World has been divided into \_\_\_\_\_ Regions, for the purpose of frequency allocation.
- vi. Bandwidth for 10MO is \_\_\_\_\_.

## Ozone & Air Pollution (Total Marks - 5)

6. (A) Fill in the blanks: (Answer any 5)

(1 × 5 = 5 Marks)

- i. \_\_\_\_\_ may have warming or cooling effects, depending on their characteristics. (Aerosols/GHGs).
- ii. In ECC ozone measurement method electrochemical reaction of ozone with Potassium iodide. (T/F)
- iii. In diurnal variation, concentration of ozone is maximum at night time. (T/F)
- iv. PM10 is the aerosol of size \_\_\_\_\_ than 10 micrometer diameter. (More/Less)
- v. \_\_\_\_\_ is naturally occurring greenhouse gases. (Water Vapour/ N<sub>2</sub>O).
- vi. Concentration of total Column Ozone in ozone hole over Antarctica is \_\_\_\_\_. (Zero / above Zero)
- vii. 90 % of atmospheric Ozone is found in \_\_\_\_\_ (Stratosphere /Thermosphere)

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