भारत मौसम विज्ञान विभाग
सूचना संचार एंव उपकरण प्रशिक्षण केंन्द्र, नई दिल्ली
(विश्व मौसम संगठन का क्षेत्रीय प्रशिक्षण केंन्द्र, नई दिल्ली)

Advance Training Course in Meteorological Instrumentation
&
Information System (Batch No – XI)

Final Exam: Paper –III **Max. Marks -100**

Date: 03.03.2023 **Time: - 10:30-13:30 Hrs**

Surface Instruments (Total 10 Marks)

Q1 (A) Fill in the blanks: (Answer any 4) **(1 × 4 = 4 Marks)**

i. In hair hygrograph the length of hair used is approximately _____
ii. Duration of bright sunshine is takes in to account duration when direct solar radiation exceeds ____ Wm^{-2}.
iii. Under standard conditions, a mercury column of 760 mm exerts a pressure of _____hpa.
iv. Markings on chart of SRRG are made for ____ hours.
v. Fixed cistern barometer used in IMD is _____barometer
vi. In Stevenson's screen, the bulb of maximum thermometer is generally kept downward at an angle of _____to the horizontal.
vii. Surface temperature generally refers to free air at a height of _____m.
viii. If collector area of rain gauge is 200 cm^2 then volume of water corresponding to 1 cm of rain is _____ cm^3.

Q1 (B) Short Answer Type Questions: (Answer any 3) **(2 × 3 = 6 Marks)**

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

Aviation Instruments, AWS & ARG (Total 20 Marks)

Q2 (A) Fill in the blanks: (Answer any 5) **(2 × 5 = 10 Marks)**

i. The wind Cross wind speed is measured at Airport by _____ sensor and
ii. A datum value is used in satellite communication of AWS for measuring _____
iii. An accurate estimate of the height of base of low clouds is measured by _____.
iv. Low visibility is a crucial factor affecting traffic at _____.
v. An accurate estimate of the height of base of low clouds is measured by _____.
vi. Minimum site requirement is _____ for Met instruments at Airport and Instrumental measurement of RVR is _____
vii. GPRS based AWS is _____ way communication.
viii. Accuracy required for wind speed is operationally desirable accuracy as per ICAO is _____ and _____.

Q2 (B) State true or False with Justification: (Answer any 5) **(2 × 5 = 10 Marks)**

i. Rain gauge (TBRG) is a digital sensor.
ii. An ultrasonic wind sensor does not require maintenance.
iii. The function of DIWE is similar to that of CWIS, but no monitoring of wind data.
iv. The ceilometer sensor may be installed MBR room for measurement of base of the cloud.
v. Agro AWS have soil sensors used for measurement soil temperature and soil moisture.
vi. Dew Point is measured by sensors in IMD AWS and IMD ARG network
vii. The sensing element of Temperature in AT/RH sensors is Pt 100.
viii. Air Temperature/ Relative Humidity probe kept inside the NEMA Enclosure Box and are used for measurement air temperature and relative humidity in AWS.

Satellite Meteorology (Total 50 Marks)

Q3 (A) Fill in the blanks. (Answer any 4) **(1 × 4 = 4 Marks)**

i. _____ meters diameter antenna is used to receive the data from INSAT-3D/3DR satellite.
ii. _____&_____ modulation technique used in Imager and Sounder payloads of INSAT-3D/3DR satellite to receive the signals.
iii. GPS satellites Caries Atomic Clock on board and transmit two low power radio signals, L1=_____ and L2 =_____.
iv. Multipath effects are removed by _____Antennae.
v. Tropospheric delay = Hydrostatic Delay + _____.
vi. Weighted Mean temperature of the vertical atmosphere Tm=55.8+0.77*____.

Q3 (B) True or false with reasoning. (Answer any 3) **(2 × 3 = 6 Marks)**

i. Down converter converts the radio frequency (RF) to Intermediate Frequency (IF).
ii. INSAT-3D/3DR is a geostationary satellite.
iii. In order to reduce the multipath effects a 5º elevation cut-off angle is fixed.
iv. GNSS signal travels in the Troposphere, Signal delays are unrelated to frequency below 30 GHz.

Q3 (C) Fill in the blanks with suitable answer. : (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 it are ……. Axis.

Q3 (D) True/False with suitable reason: **(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. If the satellite is placed in lower orbit then the camera onboard the satellite gives better resolution. (true/false)

Q3 (E) Fill in the Blanks. (Answer any 4) **(1 × 4 = 4 Marks)**

i. The resolution of INSAT 3D Sounder is …….
ii. INSAT-3DR is having……channel sounder.
iii. The INSAT 3D satellite is located at ……°E.
iv. The resolution of INSAT 3D TIR1 & TIR2 imager channel is …….
v. INSAT 3D & 3DR is a …… type of satellite.
vi. Temperature profile can be derived from INSAT-3DR …….

Q3 (F) True/False with suitable reason. (Answer any 3) **(2 × 3 = 6 Marks)**

i. INSAT 3DR Water vapour channel resolution is of 8 Km.
ii. INSAT-3D & 3DR is having four payloads.
iii. ROSA is payload of Metop Satellite
iv. Wien's Displacement Law states that radiation emitted by a black body is a function of wavelength (λ) and temperature (T).
v. A polar orbit is an orbit in which a satellite passes above or nearly above the equator.
vi. INSAT 3D & 3DR satellites are operated in a staggered mode to receive data every half hourly.

Q3 (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 vapor content can be gained from two water vapor (H2O) lines at ……. and …….GHz
iv. Carbon dioxide (CO2) spectral bands at ------ and -------- microns give us information on the temperature structure of the atmosphere.
v. In a physical retrieval ----------scheme must be used.

Q3 (H) Short notes. (Answer any 2) **(3 × 2 = 6 Marks)**

i. Write in brief about active and passive remote sensing.
ii. Write down the resolution of following imager channel from INSAT 3D satellite
a) Visible b) MIR c) SWIR
iii. What are the merits and demerits of Polar orbiting satellite?
iv. Short Notes on : i) Imager ii) Sounder

Q3 (I) Fill in the Blanks: (Answer any 4) **(1 × 4 = 4 Marks)**

i. Water vapor channel is sensitive to the _____ part of the atmosphere.
ii. Night time fog is mainly derived using channel differencing techniques using the difference of _____ (TIR &MWIR / WV & SWIR).
iii. Temperature profile can be derived from INSAT-3DR_____.
iv. SEVIRI imager has uses _____spectral channels in visible and IR region.
v. GERB stands for_____.
vi. SEVIRI stands for_____.

Q3 (J) True/False with suitable reason. (Answer any 3) **(2 × 3 = 6 Marks)**

i. Generation and dissemination of T-phi gram is possible at district level from Satellite data.
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)

Q4 (A) Choose the correct alternative: (Answer any 4) **(1 × 4 = 4 Marks)**

i. The Temperature sensor in GPS based radio-sounding is of
   a) Bead type b) Digital IC c) capacitive type
ii. Which is not a scheduled time of observation for upper air balloon ascents?
   a) 0530 IST b) 0830 IST c) 1730 IST
iii. The GPS based radio sounding system operates on the following frequency:
   a) 403 MHz b) 800 MHz c) 1200 MHz
iv. The Intermediate frequency (IF) of RSGE system is…….……MHz.
   a) 10.7 MHz b) 33 MHz c) 68 MHz
v. Which of the IMD station is part of WMO-GUAN network?
   a) Chennai b) Portblair c) Srinagar
vi. Which of the following is not a parameter observed in radio wind observation
   a) Temperature b) Wind Direction c) Wind speed
vii. IMD has a network of ……. Stations in its RS/RW upper air network.
   a) 56 b) 62 c) 99

Q4 (B) True or False with reason. : (Answer any 3) **(2 × 3 = 6 Marks)**

i. Wind profilers are Doppler radars with limited utility.
ii. SODAR system works on Microwave Frequencies.
iii. Wind observation in GPS based radio-sounding systems are based on the drift of the balloon in atmosphere
iv. GPS based systems are semi-automatic systems.
v. RSGE sounding systems are used as stand by equipment at each of the RS/RW station.
vi. Radio theodolite systems use super-heterodyne type of Receivers.

Radio Regulation (Total Marks - 5)

Q5 Fill in the Blanks : (Answer any 5) **(1 × 5 = 5 Marks)**

i. Bandwidth for H002 is _____.
ii. ITU stands for_____.
iii. International management of the radio-frequency spectrum and satellite orbits is coordinated by_____.
iv. _____are fundamental to the operation of today's ICT networks.
v. _____ radio communication services are covered under NFAP-2018.
vi. World has been divided into _____Regions, for the purpose of frequency allocation.

Ozone & Air Pollution (Total Marks - 5)

Q6 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. PM10 is the aerosol of size _____ than 10 micrometer diameter. (More/Less)
iii. _____ is naturally occurring greenhouse gases. (Water Vapour/ N2O).
iv. Concentration of total Column Ozone in ozone hole over Antarctica is _____. (Zero / above Zero)
v. Surface Ozone is _____ for human beings. (Good / Bad)
vi. 90 % of atmospheric Ozone is found in _____. (Stratosphere / Thermosphere)
vii. Excessive release of carbon dioxide in the atmosphere is the cause of _____ effect which produces global warming.
viii. A decrease in the concentration of ozone in the stratosphere is the cause of the formation of _____ holes.
ix. Total columnar Ozone is measured by_____. (Sky radiometer / Brewer Spectrophotometer)
x. CFCs are not recommended to be used in refrigerators because they_____.

_____* * * ____