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 – XIII) / Direct Recruited Scientist Course (Instrumentation) Batch - II

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

Date: 15.03.2024 **Time:- 10:30-13:30**

Surface Instruments (Total 10 Marks)

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

i. The diameter of muslin used for wet bulb thermometer is _____ mm.
ii. Height of the bulbs of the wet and dry bulb thermometer shall be between _____and _____meters above the ground.
iii. The rim of the rain gauge should be exactly horizontal and remain at a height of _____, above the ground level.
iv. _____for measuring the direction of movement of cloud Surface.
v. To obtain the full range of 10 mm on the scale of SRRG chart _____ of water is poured from measuring glass.
vi. In hair hygrograph the length of hair used is approximately _____.

1. (B) Answer the following questions: (Answer any 3) **(2 × 3 = 6 Marks)**

i. What are the Cards used in Campbell Stokes sunshine recorder and its usage time periods?
ii. What is the principle of working of Hair Hygrograph?
iii. Where Rain gauges are preferred to be installed either on ground level or on the roof ? and state the reason along with principle/law behind that if any?
iv. Explain the basic principle on which Dynes Pressure Tube Anemograph Works?
v. Why mercury is used in thermometer, barometers etc.?

Aviation Instruments, AWS & ARG (Total 20 Marks)

2. (A) Fill in the blanks: (Answer any 10) **(1 × 10 = 10 Marks)**

i. The averaging period for surface wind observations used for take-off and landing should be_____ minutes. For meteorological reports disseminated beyond the aerodrome, the averaging period should be _____minutes.
ii. In a Potentiometric wind vane of 10 KΩ Pot, if 7.5 KΩ corresponds for north then 2.5 KΩ corresponds to _____.
iii. _____formula is used to find out the wind speed at height h metres above the ground level.
iv. TDMA based AWS is _____way communication.
v. Real time embedded controller named _____is also used to convert digital signals in Drishti Transmissometer.
vi. Airport meteorological site dimensions of at least _____ and within ____ from Central line of runway.
vii. The least power consuming sensor in basic AWS is_____.
viii. Laser ceilometer is an equipment used for measuring the height of the base of clouds, which are hazardous to aviation services, up to a maximum limit of _____ meters.
ix. The sensor used in ATRH Humidity part is _____.
x. The unit of Luminous flux (F) is _____ and the unit of Luminous intensity is_____ .
xi. For Better efficiency, AGRO-AWS Solar panel is installed in _____ direction.
xii. GPRS based AWS is _____way communication.

2. (B) Indicate True or False with justification: (Answer any 5) (2 × 5 = 10 Marks)

i. The temperature and humidity sensor is mounted at 2 to 2.5m height and wind sensor at 10 m height.
ii. The basic sensor for the temperature is Pt-100 whose resistance is 100 ohms at 10°C.
iii. The sensor for relative humidity is resistance based.
iv. The rainfall value is reset at 03 UTC & 12 UTC and fresh logging and accumulation of the rainfall.
v. The soil temperature sensor is buried 20 cm below ground level.
vi. As per the National Accreditation Board for Test and Calibration Laboratories (NABL), New Delhi, a minimum of Four-point calibration is required to be done for thermometers.
vii. Rain gauge (TBRG) is a digital sensor.

Satellite Meteorology (Total 50 Marks)

3. (A) Fill in the blanks: (Answer any 4) (1 × 4 = 4 Marks)

i. A satellite cross link means_____ link.
ii. The length of _____ defines the size of satellite's orbit and It is_____ of the major axis.
iii. Troposphere is medium for _____.
iv. The full duplex round trip delay through a synchronous satellite is _____ .
v. GPS works through a technique _____.
vi. _____ & _____modulation technique used in Imager and Sounder payloads of INSAT-3D/3DR satellite to receive the signals.

3. (B) Indicate True or False with justification: (Answer any 3) (2 × 3 = 6 Marks)

i. Passive satellite amplifies the transmitted signals before re-transmitting them to Earth.
ii. The time period of a satellite orbiting around the earth depends on Mass of the earth.
iii. Once the satellite launched into orbit, the only force governing its motion is the force of fuel driven.
iv. The Geo stationary satellite follows an orbit parallel to equator and rotates the same period of 24 hours as the earth.
v. INSAT-3D/3DR is a polar satellite.

3. (C) Fill in the blanks: (Answer any 4) (1 × 4 = 4 Marks)

i. If Two satellites of mass M (satellite-A) and 2M (Satellite-B) are orbiting at the same height. Then the satellite A will have _____ more/less/equal orbital speed than that of satellite B.
ii. The height of geostationary satellite from the centre of the earth is _____ Km.
iii. Eccentricity of a ……orbit is zero.
iv. …….. force tends the satellite towards earth while …… force tends the satellite away from the earth.
v. If the satellite is placed in _____ orbit, then it takes _____ time to travel around the earth and it covers more earth's surface at one time.
vi. Orbital slots are allocated to the Satellite operator by _____

3. (D) Indicate True or False with justification: (Answer any 3) (2 × 3 = 6 Marks)

i. GEO Satellites have a very poor coverage over Poles.
ii. Signals transmitted from a MEO satellite travel a shorter distance.
iii. Transmission delay is least in GEO Satellite communication system.
iv. A few minutes disturbance in space communications occurs twice a year during Sun blinding when sun, Moon and earth are in line.
v. Ka band is cost effective as compared to X band for satellite communication.

3. (E) Fill in the blanks: (Answer any 4) (1 × 4 = 4 Marks)

i. Transmissions in certain frequencies such as ……. bands can experience interference from heavy rain or snow (Ka/Ku or S/C) .
ii. Radio jammer works by the transmission of radio signals that disrupt communications by …… (decreasing/increasing) the signal-to-noise ratio.
iii. The axis of the Earth makes an angle of _____ with its orbital plane.
iv. A typical signal strength received from a geosynchronous communication satellite is of the order of a few_____.
v. Temperature profile can be derived from INSAT-3DR _____
vi. Megha-Tropiques is a …….. satellite.

3. (F) Indicate True or False with justification: (Answer any 3) (2 × 3 = 6 Marks)

i. MEO satellites are located at altitudes between 5000 to 10000 KM.
ii. The most popular access method is TDMA.
iii. MPEG-4 provides the major advantage is the reduction in bit rate offered in satellite television.
iv. A polar orbit is an orbit in which a satellite passes above or nearly above the equator.
v. ROSA is payload of Metop Satellite.

3. (G) Fill in the blanks: (Answer any 4) (1 × 4 = 4 Marks)

i. The number of days when Earth's shadow falls on a geosynchronous satellite is _____.
ii. A helical antenna is used for satellite tracking because of _____ .
iii. In satellite communication _____modulation is used. frequency
iv. Rain has _____more/less atmospheric attenuation of transmission signal as compared to snow.
v. Carbon dioxide (CO2) spectral bands at _____and _____microns give us information on the temperature structure of the atmosphere.
vi. IAPP stands for_____.

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

i. Types of Orbits.
ii. Short note on Kepler's Laws.
iii. Short Notes on: i) Orbital Slots ii) Orbital Perturbations
iv. What are the merits and demerits of Polar orbiting satellite?

3. (I) Fill in the blanks: (Answer any 4) (1 × 4 = 4 Marks)

i. As the height of a satellite orbit gets lower, the speed of the satellite _____.
ii. _____ is a loss of power of a satellite downlink signal due to earth's atmosphere.
iii. The noise temperature of sky is about _____ °K.
iv. For satellite transmission, analog signals may be converted into digital form with the help of _____.
v. System satellites orbit the Earth once in_____hrs.
vi. Water vapor channel is sensitive to the _____part of the atmosphere.

3. (J) Indicate True or False with justification: (Answer any 3) (2 × 3 = 6 Marks)

i. To cover all inhabited regions of the Earth, five numbers of geosynchronous communication satellites required.
ii. In satellite communication Amplitude modulation is used.
iii. Low-Earth-orbit (LEO) satellites have equatorial orbits.
iv. GPS satellites are GEO satellites.
v. A satellite whose orbital plane is inclined close to 45 degrees with respect to earth equatorial plane is called polar orbiting satellite.

Radiosonde / Radio wind System (Total Marks - 10)

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

i. Pressure is calculated from _____,_____&_____ according to _____law.
ii. Balloon tracking technique in RSGE system is _____ and frequency used is _____.
iii. The sounding system computes various parameters at different levels in the upper atmosphere up to _____height.
iv. Above _____ troposphere level there is inadequate water vapour present to produce a _____.
v. How many IMD station is part of WMO-GUAN network.
   a. 03 b. 04 c. 05 d. 06
vi. The Temperature sensor in GPS based radio-sounding is of
   a. Bead Type b. Digital IC c. capacitive type

4. (B) Indicate True or False with justification: (Answer any 3) (2 × 3 = 6 Marks)

i. SODAR (Sonic Detection And Ranging), is a meteorological instrument which measures the absorption of sound waves by atmospheric turbulence.
ii. Velocity is calculated from the difference between two positions but directly issued from Doppler.
iii. Position is calculated every second by triangulation method between 3 or more satellites.
iv. The TURNSTILE antenna is capable to receive signals from within the range of 500 kms.
v. Tracking of pilot balloon (PB) in optical theodolites is a fully automatic observation.

Radio Regulation (Total Marks - 5)

5. (A) Fill in the blanks: (Answer any 5) (1 × 5 = 5 Marks)

i. Electromagnetic waves of frequencies arbitrarily lower than _____, propagated in space without artificial guide.
ii. Designation of Emissions expressed by _____ numerals and _____ letter.
iii. A minimum of _____ symbols are used to describe the basic characteristics of radio waves.
iv. World has been divided into _____Regions, for the purpose of frequency allocation.
v. Bandwidth for 1M25 is _____.
vi. The first Symbol is used to describe the basic characteristics of radio waves_____.
vii. International management of the radio-frequency spectrum and satellite orbits is coordinated by_____.

Ozone & Air Pollution (Total Marks - 5)

6. (A) Fill in the blanks: (Answer any 5) (1 × 5 = 5 Marks)

i. Ozone layer to become ozone hole, the concentration of ozone should be less than _____Dobson Unit. (200, 220, 300, 400)
ii. UV A may cause _____ and UV B may cause_____ .
iii. Which Greenhouse gases has the shortest residence time in the atmosphere? (Methane, CO2, NO2, CFC)
iv. Concentration of ozone is generally less in _____. (Winter/Rainy/Summer)
v. PM 2.5 is inhalable aerosols. (T/F)
vi. _____ is the most important sink of aerosol particles in the troposphere.
vii. Concentration of total Column Ozone in ozone hole over Antarctica is _____ .(Zero / above Zero.

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