भारत मौसम विज्ञान विभाग

सूचना संचार व उपकरण प्रशिक्षण केन्द्र, नई दिल्ली

(विश्व मौसम विज्ञान संगठन का क्षेत्रीय प्रशिक्षण केंद्र)

**India Meteorological Department**

**Information Communication & Instrument Training Centre, New Delhi**

**Regional Training Centre, World Meteorological Centre**

**DIRECT RECRUITED SCIENTIST TRAINING COURSE (INSTRUMENTATION) BATCH NO – II /**
**ADVANCE TRAINING COURSE IN METEOROLOGICAL INSTRUMENTATION & INFORMATION SYSTEM**
**BATCH NO – XIII**
**MID TERM EXAMINATION**
**Date – 28.11.2023**

**Time:  03:00 Hours (10:30AM – 01:30PM)**                     **Total Marks: 150 Marks**

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### Principle of Radar and Radar Meteorology

**1. (A) Fill in the blanks. (Any 10)**                              **(1 x 10 = 10 Marks)**

I. For a pulse radar with maximum unambiguous range of 60 Kms, the maximum allowable pulse repletion frequency (PRF) is _____.

II. Echoes are observed from _____in Radars?

III. In what region of the EM spectrum, Radars are operated?

IV. Radars range is dependent on _____.

V. Time intervals between successive pulses of the clock are referred to as _____.

VI. Radar resolution has unit _____.

VII. Three dimensional Radar determines_____.

VIII. X band radar operates on _____frequency.

IX. _____of the transmitted pulse determines the range resolution of radar.

X. Problem of ambiguous range measurements is encountered in _____radar.

XI. If maximum range has to be doubled, the peak power has to be increased by a factor of _____.

XII. In a radar, if peak transmitted power is increased by a factor of 16 and the antenna diameter is increased by a factor of two, then the maximum range will increase by a factor of_____.

**1. (B) Write true or false with brief explanation. (Any 5)**                  **(2 x 5 = 10 Marks)**

I. In a RADAR system the transmitter of the radar is more sensitive than the receiver.

II. For radar system, antennas with a large beam width are preferred over narrow beam antennas.

III. The radar in which both transmission and reception is done using the same antenna are called Monostatic radar.

IV. When a power Pt is transmitted by an antenna, amount of energy incident on the target is given by the expression $Pt \times G/4\pi R^2$

V. The term radar cross section defines the Scattering ability of the target

VI. A pulse radar determines the target range by measuring the round trip time of a pulsed microwave signal.

VII. The Range of X-band Radar is higher than S-band Radar.

## Principle of Satellite Technique

**2. (A) Fill in the blanks. (Any 10)**                                    **(1 x 10 = 10 Marks)**

I.  Height of geostationary satellite is _____Kms.
II.  As the height of Satellite orbit gets lower, its speed _____.
III.  _____Polarization is used in the Safelight antenna.
IV.  End of life date for INSAT-3DR is _____.
V.  In INSAT-3DR, R stands for _____.
VI.  DRT of INSAT-3DR stands for _____.
VII.  Downlink central frequencies of INSTA-3DR imager and sounder are _____and _____.
VIII.  DRT payload of INSAT-3D satellite is having uplink frequency _____ and downlink frequency_____.
IX.  _____ & _____encoding technique used in imager and sounde of INSAT- 3D/3DR satellite.
X.  Signals are received from a ground station, amplified, and sent back to Earth on a different frequency by a _____.
XI.  The transfer of signals from an Earth-based ground station to a satellite is referred to as the _____in satellite communication.
XII.  A circular orbit's eccentricity is equal to_____.

**2. (B) Write True or False with brief explanation. (Any 5)**                **(2 x 5 = 10 Marks)**

I.  Inclination angle of a polar orbit is 180 degrees
II.  The orbital radius is the distance between Earth's major axis and the satellite
III.  Eccentricity and semi-major axis are the two parameters required to measure orbital radius.
IV.  The orbital velocity of a safelight is given by v = (G * M / r) ^ (1/2), Where G is the gravitational constant, M is the mass of the Earth, and r is the orbital radius
V.  INSAT-3D/3DR is a polar satellite
VI.  In the present ground receiving an operational set of INSAT-3D/3DR is using Low Noise Amplifier  (LNA) in extended C-Band.
VII.  GNSS Signal delays more in the Troposphere due to wind.

## Introduction about AWS and ARG

**3. (A) Fill in the blanks. (Any 10)**                                     **(1 x 10 = 10 Marks)**

I.  In the tipping bucket rain gauge When one compartment fills with _____mm of rainwater, the bucket tips,
II.  Rain Gauge must be installed at a distance _____or _____the height of the building or obstruction
III.  Communication protocol used in AWS is _____.
IV.  Antenna used for satellite communication in AWS is_____.
V.  Two winds sensors are installed in Agro AWS are at heights _____and_____.
VI.  Satellite based AWS has _____way communication
VII.  GPRS based AWS has _____way communication
VIII.  AWS antenna is _____array
IX.  IoT stands for _____.
X.  General resolution of a rain gauge is _____.
XI.  A standardized drop size as used for laboratory purposes is defined as _____.
XII.  Two winds sensors are installed in Agro AWS are at heights _____and _____.

**3. (B) Write True or False with brief explanation. (Any 5)**           **(2 x 5 = 10 Marks)**

     I. The height of mast of IMD ARG System is 3 m.
     II. The surface meteorological observations are being automated by installation of AWS.
     III. The AWS are broadly classified into two types Real time and Off-line AWS.
     IV. The backbone of AWS is the usage of the telemetry concept.
     V. GPRS telemetry do not offer higher temporal resolution of data transmission as compared to satellite telemetry.
     VI. Tipping Bucket Rain Gauge is a precision instrument with a sensitivity of 0.5 mm per tip used by IMD in their AWS and ARG network.
     VII. Ultrasonic wind sensor which is a very robust, lightweight unit with no moving parts. The measurement range is 0-116 knots (0 to 60 mps) for wind speed and 0- 359° for wind direction.

## Concepts of optical fibre & Wireless Communication

**4. (A) Fill in the blanks. (Any 6)**           **(1 x 6 = 06 Marks)**

     I. Range of optical communication is
         a. 700 nm to 1700 nm.
         b. 800 nm to 1200 nm
         c. 800mm to 1600 mm
         d. None of the above
     II. A multimode fiber has RMS pulse broadening per km of 12ns/km and 28ns/km due to material dispersion and intermodal dispersion resp. The total RMS pulse broadening.
         a. 30.46ns/km
         b. 31.23ns/km
         c. 38.23ns/km
         d. 54.26ns/km
     III. OTDR means _____ for optical fibres.
     IV. Intermodal dispersion is non-existent in _____ fibers.
     V. Three optical windows in fiber optics communication are _____.
     VI. The scattering resulting from fiber imperfections like core-cladding RI differences, diameter fluctuations, strains, and bubbles is_____.
     VII. Law governing Optical fibre communication is _____.
     VIII. _____ is a device which reconstitutes a transmitted digital optical signal.

**4. (B) Short Answer Type Questions. (Any 3)**           **(3 x 2 = 06 Marks)**

     I. What is the cutoff wavelength for singlemode fiber?
     II. What are the problems with the direct conversion of analog video signals into optical signals?
     III. What are the advantages of fiber optic Audio Video systems in hazardous environments?
     IV. What are the types of fiber optic connectors?
     V. What is an optical loss budget?

**4. (C) Short Note. (Any 1)**           **(3 x 1 = 03 Marks)**

     I. What is the working principle of a Laser diode?
     II. What are the merits of Laser over LEDs and merits of LEDs over Laser?

## Principle of Satellite Communication

**5. (A) Fill in the blanks. (Any 10)**                                    **(1 x 10 = 10 Marks)**

I.    _____type of satellite amplifies the transmitted signals before re-transmitting them to Earth?
II.   _____Satellite orbit requires no tracking.
III.  Three basic types of orbits are _____, _____ and _____.
IV.   Two types of Sub-Synchronous Orbits are _____ and _____.
V.    Two types of synchronous orbits are _____ and _____.
VI.   _____ orbit is mainly used for communications.
VII.  Low Earth orbit (LEO) is an orbit around Earth with an altitude between _____ and _____.
VIII. Sun transit outage is an interruption in, or distortion of geostationary satellite signals caused by interference from_____.
IX.   The value of eccentricity of a satellite orbit lies between _____ and_____.
X.    The transmitter-receiver combination in the satellite is known as a_____.
XI.   Propagation delay of satellite systems is _____than that of conventional terrestrial systems for communication. (more/less)
XII.  Transmission cost is independent of coverage area in _____. (Satellite communication / conventional terrestrial systems)

**5. (B) Write True or False with brief explanation. (Any 5)**              **(2 x 5 = 10 Marks)**

I.    A geostationary orbit is one in which a satellite orbits the earth at exactly the same speed as the earth turns.
II.   Orbital period for LEO system is 24 hours.
III.  The six Keplerian elements are: Eccentricity (e), Semi major axis(a), Mean anomaly (Mo), Argument of perigee (ω), Inclination (i), Right ascension (Ω)
IV.   The azimuth and elevation angles of the ground station antenna are termed as look angles.
V.    Ascending node is the point where the orbit crosses the equatorial plane going from south to north.
VI.   Kepler's third law states that the square of the periodic time of orbit is proportional to the cube of the mean distance between the two bodies.
VII.  INSAT-3DR is a multipurpose LEO spacecraft with main meteorological payloads (imager and sounder).

## Introduction to Networking

**6. (A) Fill in the blanks. (Any 10)**                                    **(1 x 10 = 10 Marks)**

I.    ICMP is _____.
II.   IPv6 is a _____bit hexadecimal address.
III.  _____ports are used to connect peripheral devices like mouse.
IV.   A resource's online location is indicated by its_____.
V.    Half duplex communication connection requires _____number of wires.
VI.   Router is a layer _____device.
VII.  Gateway operates in _____Layer.
VIII. Speed of Cat 6 cable is _____.
IX.   Class E ip is reserved for _____.
X.    RJ is abbreviated for _____in RJ45 type cable connector.
XI.   Switch works in  _____Layer of OSI model.
XII.  Wi-Fi stands for _____.

**6. (B) Write True or False with brief explanation. (Any 5)**　　　　　　　　**(2 x 5 = 10 Marks)**

    I.    OSI Model has 5 layers.
    II.    Speed of Cat 7 cable is 10Gbps.
    III.    Cat 1 carries only voice.
    IV.    Transfer rate of Cat 6 and Cat 7 cable is same.
    V.    IPv4 address is 32 bit unique address.
    VI.    NVMe is a cache memory.
    VII.    USB is a serial communication device.

## Introduction to web designing

**7. (A) Fill in the blanks. (Any 06)**　　　　　　　　**(1 x 6 = 06 Marks)**

    I.    ISP stands for_____.
    II.    What is Google Chrome?
        a)   An website
        b)   A File Manager
        c)   A third party software
        d)   The Internet
    III.    PHP stands for _____.
    IV.    HTML stands for _____.
    V.    PHP is _____ side scripting language.
    VI.    _____ colour names are used by the browsers.
    VII.    _____ attribute is used to identify the values of variables.
    VIII.    _____ are used with a tag to modify its function in HTML.

**7. (B) Short Answer Type Questions. (Any 3)**　　　　　　　　**(3 x 2 = 06 Marks)**

    I.    What is the difference between HTML element and tag?
    II.    What are white spaces and how do they affect web content?
    III.    What is web server?
    IV.    Can you give a background color in HTML? Give any example.
    V.    How do you set an image as a background of a web page?

**7. (C) Short Note. (Any 1)**　　　　　　　　**(3 x 1 = 03 Marks)**

    I.    What is an Anchor tag in HTML?
    II.    What is JavaScript? Describe briefly.

# Introduction to RSRW

**8. (A) Fill in the blanks. (Any 10)**                     **(1 x 10 = 10 Marks)**

     I.    Upper air observations are taken at _____ times.
    II.    In Pilot Balloon Observations elements of observation are _____ and _____.
    III.    _____ is used as temperature sensor in RSRW.
    IV.    _____ is used as humidity sensor in RSRW.
    V.    _____ to _____ is the frequency range of RSRW.
    VI.    The frequency of data transmission to the ground station in RSRW is _____.
    VII.    Balloon of RSRW can be filled with _____ and _____ gases.
    VIII.    _____ modulation is used in RSRW.
    IX.    GPS is a constellation of _____ satellites.
    X.    GPS ground based antenna is _____ polarized.
    XI.    Yagi Antena elements are _____, driven element and _____.
    XII.    SODAR stands for _____.

**8. (B) Write True or False with brief explanation. (Any 5)**                     **(2 x 5 = 10 Marks)**

    I.    GPS require minimum 3 satellites to lock in to a moving object.
    II.    Temperature is observed in radio wind observation.
    III.    A message sequence protocol is defined for RSRW data.
    IV.    GPS based RSRW is fully automatic system.
    V.    SODAR system works on sonic waves.
    VI.    Pressure sensor is commonly used to measure pressure in RSRW system.
    VII.    Multiple or dual redundant antennas can be used for RSRW systems.

_____***_____