

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

Final Exam: Paper –II

Max. Marks -100

Date: 13.03.2024

Time:- 10:30-13:30

**OPERATION & MAINTENANCE OF VARIOUS WEATHER RADARS**

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

(1 × 4 = 4 Marks)

- The number of elevation angles in IMD-C scan is \_\_\_\_\_ and the number of elevation angles in IMD-B scan is \_\_\_\_\_ with maximum elevation angle fixed at \_\_\_\_\_ °.
- One of the limitations of radar measurements is the attenuation of radar waves due to \_\_\_\_\_ & \_\_\_\_\_ as they travel through the atmosphere, which can affect the accuracy of data.
- In Doppler Weather Radar data, the phenomenon known as the "bright band" is related to the radar's response to \_\_\_\_\_ and ice conditions, which can impact precipitation measurements.
- To mitigate the impact of non-meteorological targets contaminating radar returns, weather radar systems employ various techniques, such as \_\_\_\_\_ and \_\_\_\_\_.
- Radar beam widening at long ranges can lead to decreased \_\_\_\_\_ of the radar signal, making it less effective for monitoring distant weather conditions.
- Maintenance and Calibration of Doppler Weather Radars are essential to ensure the accuracy of \_\_\_\_\_ and \_\_\_\_\_.

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

(2 × 3 = 6 Marks)

- Radar beam widening at long ranges can enhance the radar's ability to detect small-scale weather phenomena.
- The curvature correction applied in Doppler Weather Radar accounts for the curvature of the Earth and ensures accurate measurements, especially at shorter distances.
- The bright band phenomenon in Doppler Weather Radar data can lead to overestimation of rainfall intensity.
- 30 dBm = 1 mW.
- S-Band Radars cannot be used for thunderstorm studies.

**RADAR METEOROLOGY**

2. (A) Fill in the blanks: (Answer any 10)

(1 × 10 = 10 Marks)

- In Rayleigh scattering, the intensity of scattering is proportional to \_\_\_\_\_ of diameter of scattering particle.
- The unambiguous velocity of an S-band radar with PRF 1200 Hz is \_\_\_\_\_ m/s.
- Warm, dry air advection over cooler water surface leads to bending of EM waves below the travelling path and referred as \_\_\_\_\_.
- The Doppler Dilemma becomes more pronounced when attempting to measure \_\_\_\_\_ velocities, where the radial velocities approach or exceed the Nyquist limit.
- To mitigate the Doppler Dilemma, radar systems often employ strategies such as \_\_\_\_\_ pulse repetition frequencies.
- The back scattering cross section of the target is proportional to \_\_\_\_\_ power of diameter of the target.

- vii. The SI unit of Radar reflectivity factor (Z) is \_\_\_\_\_.
- viii. Spectrum width is a measure of the \_\_\_\_\_ of particle velocities within a radar beam, providing valuable information about turbulence and the variability in particle motion in the atmosphere.
- ix. Very High Frequency (VHF) Radars has frequencies \_\_\_\_\_ than S- Band Weather Radar.
- x. The frequency of the received signal \_\_\_\_\_ if the target tends to move in the direction of the radar.
- xi. Dual PRF is crucial for mitigating the problem of \_\_\_\_\_, which occurs when multiple target reflections overlap in the same range cell, making accurate target identification and tracking challenging.
- xii. Doppler radar data is essential for tracking the development and movement of \_\_\_\_\_ within storms.

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

**(2 × 5 = 10 Marks)**

- i. The Z-R relationship, which relates radar reflectivity (Z) to rainfall rate (R), is a fixed and universal constant.
- ii. Spectrum width measurements from radar data can provide insights into the spatial distribution of precipitation within a storm.
- iii. Radar systems that operate in the X-band frequency range are more susceptible to atmospheric attenuation and signal absorption compared to radar systems in the S-band.
- iv. Clear-air turbulence is not detectable by radar because it primarily affects the motion of the air molecules themselves rather than precipitation particles.
- v. The Nyquist limit in radar velocity measurements can be exceeded by using higher-frequency radar waves.
- vi. The ZDR parameter in radar data is independent of the orientation of hydrometeors in the radar beam.
- vii. For radar system, antennas with a large beam width are preferred over narrow beam antennas.

**RADAR TECHNOLOGY**

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

**(1 × 4 = 4 Marks)**

- i. The Klystron Amplifier is a crucial component in radar systems, known for its ability to provide \_\_\_\_\_ amplification of microwave signals.
- ii. Anomalous propagation of radar waves occurs when these waves experience \_\_\_\_\_ due to complex atmospheric conditions
- iii. Phased array radar offers improved radar capabilities by electronically controlling the \_\_\_\_\_ of individual elements in the antenna array, allowing for rapid beam steering.
- iv. Servo amplifiers are responsible for precisely controlling the \_\_\_\_\_ of radar antennas to ensure accurate target tracking and signal reception.
- v. STALO is a critical component in radar systems that provide a stable and precise \_\_\_\_\_.
- vi. In waveguides, the two modes of propagation are \_\_\_\_\_ & \_\_\_\_\_.

**3. (B) Explain in brief: (Answer any 3)**

**(2 × 3 = 6 Marks)**

- i. Explain the statement “A radar antenna with a higher gain will always provide better resolution in target detection”.
- ii. What is the primary function of the RF amplifier in a radar system, and why is it essential?
- iii. How does the concept of polarization impact the radar's ability to detect and characterize targets?
- iv. Explain the phenomenon of Super Refraction and its implications for radar signal propagation.
- v. Define Super refraction and Sub refraction.

## METEOROLOGICAL COMMUNICATION SYSTEMS

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

- i. One essential component of a message switching system is the creation of \_\_\_\_\_, which dictate how messages should be forwarded to their intended recipients
- ii. The scheduler in a message switching system is responsible for optimizing the allocation of \_\_\_\_\_ to ensure timely message delivery.
- iii. Routing tables help determine the \_\_\_\_\_ for data packets to reach their destination efficiently.
- iv. Effective management of routing tables is crucial for minimizing \_\_\_\_\_.
- v. Channel configuration in meteorological communication systems involves optimizing the allocation of \_\_\_\_\_ to ensure efficient data transmission.
- vi. Proper channel configuration is essential for minimizing \_\_\_\_\_ and ensuring reliable data transmission in crowded wireless environments.
- vii. Video conferencing systems often incorporate advanced \_\_\_\_\_ algorithms to optimize video quality and bandwidth utilization.
- viii. \_\_\_\_\_ technology takes video conferencing to the next level by providing an immersive and lifelike experience, where participants feel as if they are in the same physical location.
- ix. Video walls consist of an array of multiple displays that can be configured to provide a seamless and large-scale \_\_\_\_\_.
- x. The efficient management of content and real-time updates on video walls often relies on sophisticated \_\_\_\_\_ that allows users to control and customize the displayed information.
- xi. A sophisticated scheduler plays a critical role in optimizing task \_\_\_\_\_ in a multitasking operating system.
- xii. The scheduler's ability to prioritize and manage tasks in real-time is crucial for minimizing \_\_\_\_\_ and ensuring responsive system performance.

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

- i. AFTN is a global network used for the exchange of aeronautical and meteorological messages in the aviation industry.
- ii. SYNERGIE is a meteorological data processing system primarily used for managing and analyzing aviation weather information.
- iii. VSAT technology is commonly used for meteorological data transmission due to its high-bandwidth capabilities.
- iv. NCDC is responsible for the development of meteorological communication protocols used in the aviation sector.
- v. GISCs ensure seamless access to meteorological information by providing data archiving and dissemination services worldwide.
- vi. CLYSIS focuses on providing climate information primarily for land-based applications.
- vii. PWS is a component of meteorological communication systems dedicated to serving specific weather information needs of the general public.

## INTRODUCTION TO HTML AND PHP, GIS PLATFORM AND DEVELOPMENT

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

- i. HTML is a fundamental language used for creating and structuring \_\_\_\_\_ on the web.
- ii. Java script is \_\_\_\_\_ language. (Interpreted / Compiled).
- iii. PHP is a scripting language commonly used for server-side web development to create dynamic and interactive\_\_\_\_\_.
- iv. GIS is a technology that enables the capture, storage, analysis, and visualization of \_\_\_\_\_ data.
- v. XML is utilized for structuring and storing data in a format that is both human-readable and\_\_\_\_\_.

- vi. Effective \_\_\_\_\_ is crucial for organizing, storing, and retrieving data efficiently within an organization.
- vii. In the context of web development, the term "CMS" stands for \_\_\_\_\_.
- viii. Data conversion and ingest processes involve transforming data into a suitable format for storage in a \_\_\_\_\_.
- ix. In a relational database, a \_\_\_\_\_ is a unique identifier for each row in a table, ensuring that every record is distinct.
- x. In a database, data is typically organized into \_\_\_\_\_.
- xi. \_\_\_\_\_ refers to the process of integrating geographic data from multiple sources into a common coordinate system for analysis and visualization.
- xii. The extension of CSS file is \_\_\_\_\_.

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

**(2 × 5 = 10 Marks)**

- i. JavaScript is a programming language primarily used for styling web pages.
- ii. XML is primarily used for data presentation and styling in web development.
- iii. Do all HTML tags have an end tag?
- iv. GIS stands for Global Information System, which involves the use of spatial data for mapping and analysis.
- v. PHP is a server-side scripting language used for creating static web pages without interactive features.
- vi. HTML is primarily used for server-side scripting in web development.
- vii. GIS deals with vector and raster data.

### **LINUX AND SERVER MANAGEMENT**

**6. (A) Fill in the blanks: (Answer any 10)**

**(1 × 10 = 10 Marks)**

- i. To find out the IP address of a Linux server, the command used is \_\_\_\_\_.
- ii. The process ID (PID) of a running process can be obtained using the command \_\_\_\_\_.
- iii. RAID stands for \_\_\_\_\_.
- iv. The Linux command used to change the ownership of a file or directory is \_\_\_\_\_.
- v. The default port for SSH (Secure Shell) is \_\_\_\_\_.
- vi. To view the contents of a text file in Linux, the command used is \_\_\_\_\_.
- vii. A process that keeps a server running in the background is called a \_\_\_\_\_.
- viii. The \_\_\_\_\_ protocol is commonly used for securely transferring files between a client and a server in a Linux environment.
- ix. To schedule recurring tasks on a Linux server, one can use the \_\_\_\_\_ utility.
- x. In Linux, the \_\_\_\_\_ directory contains system configuration files.
- xi. To check the free disk space on a Linux server, you can use the df command. By default, it displays the disk space in \_\_\_\_\_.
- xii. The \_\_\_\_\_ command in Linux is used to create a compressed archive of files and directories.

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

**(2 × 5 = 10 Marks)**

- i. Server virtualization allows multiple virtual servers to run on a single physical server, improving resource utilization and flexibility.
- ii. SSH is primarily used for transferring files between servers in a secure manner.
- iii. Nginx and Apache are both web server software commonly used on Linux servers.
- iv. A Linux server can run both GUI and CLI simultaneously.
- v. The rm -rf command in Linux stands for "remove and recover files."
- vi. SELinux can only enforce mandatory access controls based on user identities and file permissions.
- vii. Enlist five basic linux commands to find file content. (Short answer type question)

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