Syllabus of Advanced Training in Meteorological Instrumentation & Information System

Theory Paper 2				
Learning Objective	1. To understand the basic concepts and operations of Radar 2. Introduction to basics of GTS architecture and detailed diagram of IMD Network. 3. To learn the various components of Web Designing. 4. To understand and make effective use of linux utilities and basic commands of linux operating system.			

S.No.	Subject	Module 1	Module 2	Module 3	Module 4
1.	**Radar Technology and Radar Meteorology (17P)**	**Introduction:** History of Radar Development, Radar Frequencies, Basics of Signal processing. **Theory of Microwave tubes-**Magnetron, Klystron Amplifier, Reflex Klystron, solid state. **Theory of EM waves** EM Wave propagation, Refraction of Radar waves, Anomalous Propagation, Super Refraction and Sub-refraction, Ducted propagation **Concept of polarization** Horizontal, vertical ,circular **Transmission media** Co-axial cable, wave guide **Types of radar-** DWR, Polarimetric Radar, Phased array radar. **Period Allocated: 6P**	**Doppler Weather Radar** Principle, Fundamentals, Block diagram of Doppler Weather Radar and explanation of different units: Transmitter, Receiver, STALO, RF amplifier, Wave guides, Parabolic Dish antenna, Servo amplifiers. Doppler velocity measurements, Spectrum width and turbulence, Range and velocity ambiguity, Doppler Dilemma, Effect of earth curvature on radar beam Scattering – Rayleigh and Mie, Radar Equation for a point target and for extended target. **Period Allocated: 5P**	**Products of DWR** Base and derived products (Z, V, W) their Interpretation, description and applications in nowcasting. DWR Products: Primary Products, Velocity Products, Hydrological Products, Aviation Products, Warning Products, Dual Polarization Products. **Precipitation Measuring Instruments** Disdrometer, micro rain radar, Terminal Doppler Weather Radar (TDWR), Low-level windshear alert system(LLWAS). **Period Allocated: 4P**	Case study of 2-3 Scientific paper and their analysis. Discussion on the recorded events-Thunderstorm, hailstorm, tropical cyclones etc. **Period Allocated: 2P**
2.	**Operation & Maintenance of Weather Radars (8P)**	**Observations and Reporting of DWR data** General Scan strategies, Reporting of Doppler Weather Radar Data, Uploading products on IMD website, Doppler Weather radar data for NWP modelling, Doppler Weather Radar data for composite products etc. **Period Allocated: 2P**	**Maintenance & Measurements** Antenna Setting to True North, Maintenance, calibration and Measurements of various parameters and safety instructions. Measurement principle of various instruments (Multimeter, oscilloscope, spectrum analyser etc.) **Period Allocated: 2P**	**Limitations of Radar measurements,** General Source of error, Attenuation of radar waves, Contamination of return power by non-meteorological targets, Beam widening at long ranges, Partial beam filling, Blockage of beam, Bright Band, Contamination due to returns from Side lobe, Range limitations - Earth, Curvature Correction. **Period Allocated: 2P**	**Familiarization Training** Radar network of IMD present vis-a- vis Modernization of radar network. Introduction with hardware and software of different radars at respective stations. Period **Allocated: 2P**
3.	**Web Designing & AI**	**HTML** Introduction to HTML and HTML5, HTML elements &	**PHP** Introduction to PHP, Handling HTML Form with	**Python** Introduction to Python. Basics of Meteorological	**GIS** Basics of GIS and Remote

	(10P)	Attributes, HTML Tables and HTML Forms. **CSS** Introduction to CSS. **Java Script** Introduction to Java Script and Java Script Validations. **Period Allocated: 3P**	PHP, PHP Database Creation. **DBMS** Introduction to RDBMS and SQL. Introduction to PostgreSQL. Data Conversion and Ingest to database including GIS Platform and Development. **Period Allocated: 2P**	Data Handling in Python (HDF, nc, grib,CSV etc.) Introduction to AI & ML **Period Allocated: 3P**	Sensing. QGIS Tutorial (with basic map function). **Period Allocated: 2P**
4.	Linux (4P)	**Users management:**· Users and groups(UID,GID), Useradd, groupadd commands **Account configuration** (/etc/passwd, /etc/shadow, and/etc/group), Commands to manage files **Current directory**(cd, pwd), absolute and relative paths **Pipes and I/O redirection** **Bases of file content management** (command ls, file, cat, less, more, hexdump, cmp, diff, wc, head, tail) **Commands to manage files and directories** (cp, mv, rm, mkdir, rmdir…, ln) **Permissions settings** (chmod, chown, chgrp) **File search** (find and locate) **Archiving, compression** (tar, gzip) **Period Allocated: 2P**	**Post boot checking** (dmesg) **Mount and unmount file system manually,** the /etc/fstab file **File system maintenance** (fsck,df) on and offline **Process management**(ps, kill, nohup) **Priority and resources adjustment** (nice, renice) **How to know system load**(uptime, vmstat, /proc) **RedHat package management methods** (RPM/YUM) **Installed software listing** **Install and uninstall software** **Network interface management** (hosts, resolv.conf, networks, nsswitch.conf) **IP packages filtering**:netfilter and iptables **Useful tools** (ping, traceroute, tcpdump, nmap, netstat) **Period Allocated: 2P**		
5.	**Linux Server Management (4P)**	· FTP server / Web Server / Email server installation and settings · SSH server installation and settings (SSH and SCP with key authentication) · Installation and configuration of APACHE · Stopping and starting servers, monitoring the server: log files, Administration tools · RAID Configuration & types, incremental backup, etc. · Backup & Restoration viz. ISO Imaging. · Shell scripting **Period Allocated: 2P**	**Proxmox and VMWare:** · Linux system installation from bootable CD, USB Stick, HDD · Creation of virtual machine · Dual boot system · VMware Installation and configuration · Proxmox installation and configuration **Period Allocated: 2P**		

Learning Outcomes	1. To gain knowledge on basic operations and maintenance of weather radar and to effectively interpret radar images.
	2. To understand the basics of different types of data format and networks used in IMD.
	3. Broad understanding of the IMD website management and up-gradation.
	4. To develop the skills necessary for Linux Server Management and Creation of virtual machine.