

Syllabus of Advanced Training in Meteorological Instrumentation & Information System

Theory Paper 1

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Learning Objective		<ol style="list-style-type: none"> 1. Describe the working of analog modulation and demodulation circuits. 2. Understand the concept of digital communication techniques and its advantages over analog communication. 3. Understand the basics of different mediums of communication network. 4. Understand the basics of Antenna and Radio wave propagation. 5. Understand the concepts of Networking and different types of networks used in IMD. 6. To understand structure and working of various telecommunication network. 		
S.No.	Subject	Module 1	Module 2	Module 3
1.	Communication & Analog Modulation (10 P)	<p>Concept of communication Analog and Digital Communication, Wired and wireless communications including Mobile communication and latest technology. Line Measurement, Unit of Power, Unit of attenuation, Decibel terminology. Basics of Modulation Carrier, Information Signal, Modulation Index, Modulation, Demodulation. Types of modulation.</p> <p>Period Allocated: 3P</p>	<p>Amplitude modulation Generation of AM waves. Demodulation of AM waves. Single Side Band (SSB) Modulation Vestigial Side Band (VSB) Modulation Angle modulation Frequency Modulation and demodulation, Phase Modulation and demodulation. Comparison of AM and FM systems.</p> <p>Period Allocated: 4P</p>	<p>Spectra of AM and FM, super heterodyne receivers.</p> <p>Information Theory: Entropy, mutual information and channel capacity theorem.</p> <p>Period Allocated: 3P</p>
2.	Digital Communication System (9P)	<p>Elements of Digital Communication System, Advantages & Disadvantages of Digital Communication. Information and System Capacity, Shannon's Formula.</p> <p>Period Allocated: 2P</p>	<p>Sampling Theorem : Nyquist Sampling and Demodulation of sampled signals. Quantization and Quantization Error/Noise. Pulsed Code Modulation, DPCM, Noise and S/N ratio, Delta Modulation and Adaptive Delta Modulation.</p> <p>Period Allocated: 3P</p>	<p>Digital modulation schemes: ASK, PSK, FSK, QAM, BPSK.</p> <p>Inter-symbol interference (ISI), MAP, ML detection, matched filter receiver, SNR and BER.</p> <p>Period Allocated: 4P</p>
3.	Wireless Communication (4P)	<p>Introduction to Wireless Communication System: GSM,GPRS,CDMA,2G,3G, 4G, 5G& other latest communication. Cellular Concept, Multiple Access Techniques: TDMA,CDMA, FDMA. PHY LAYER ,MAC LAYER CONCEPTS.</p> <p>Period Allocated: 3P</p>	<p>Recent Trends: Introduction to Wi-Fi, Security issues and challenges in a Wireless network.</p> <p>Period Allocated: 1P</p>	
4.	Optical Fibre Communication (6P)	<p>Overview of Optical communications, Properties of Optical fibres: Numerical aperture, acceptance angle, acceptance cone. Types of Optical fibres: Step index and Graded index fibre.</p> <p>Period Allocated: 2P</p>	<p>Optical fibre as waveguides: Modes of propagation in the fibre: Single mode and multi mode fibre. The advantages and disadvantages of optical fibre communication over copper wire communication. Splices and connectors.</p> <p>Period Allocated: 2P</p>	<p>Applications to communication & instrumentation, Signal degradation in optical fibres: Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses, Intermodal Dispersion. International standards.</p>

				Period Allocated: 2P
5.	Antenna and Wave Propagation (15P)	<p>Radio wave propagation: Radio frequencies such as HF,VHF,UHF and Microwave. Mode of propagation: Ground wave, Space wave, and Sky wave.</p> <p>Definitions of Critical frequency, Maximum usable frequency(MUF), Optimum Working Frequency (OWF), Skip distance, Virtual height. Radio noise of terrestrial and extra-terrestrial origin. Multiple fading of radio waves.</p> <p>Period Allocated: 5P</p>	<p>Basics of Antennas- Definition and functions of an antenna</p> <p>Antenna parameters and definitions: Radiation resistance, Radiation pattern, Beamwidth- HPBW, FNBW, Polarisation, Radiation Intensity Gain, Directivity, Effective height, Effective aperture, Antenna Temperature and signal to noise ratio.</p> <p>Period Allocated: 5P</p>	<p>Types of Antenna: Folded dipole, Monopole, Helical Antenna, Parabolic Antenna etc.</p> <p>Different Antenna feeds – Axial Feed, Off Axis Feed, Cassegrain Feed, and Gregorian Feed.</p> <p>Period Allocated: 5P</p>
6.	Concept of Networking & IMD Networks (6P)	<p>Concept of networking: Protocols, Packet switching and circuit switching, IP Scheme, private and public IP and masking etc.</p> <p>Modems and Communication ports: Modem function, Modem figure of merit, Theory of Modem operation, various modem standard viz V.26, V.29, V.35 etc. and wireless modems, and Multiplexers, Demultiplexers. Serial ports, Ethernet Ports, USB ports, HDMI ports, SAS ports and various port, standard like RS 232, RS 422, RS 485 etc. and connectors viz RJ 45, etc.</p> <p>Period Allocated: 2P</p>	<p>Description of data switching system: Hardware aspects, Computer architecture in the typical system (RTH Computer/ AMSS), System hardware, Communication, storage and transfer, control and display, and other sub system(like Modems, LAN switches, SAN switches, Hubs) Message flow and data control in the switching system.</p> <p>SADIS data receiver, LAN, WAN, Wi-Fi, Internet servers (Hardware), MDSS, VSAT communication.</p> <p>Period Allocated: 3P</p>	<p>IMD network: MPLS VPN (Virtual Private Network) concept, Leased line, National Knowledge Network (NKN), Internet etc.</p> <p>Period Allocated: 1P</p>
7.	Networking devices & Security System (6P)	<p>Networking devices :</p> <p>Active components:</p> <p>Router: OS installation, Basic configurations, VPN tunnel, VOIP, HSRP, Load Balancing, bandwidth management etc.</p> <p>Firewall: Different types of firewall (Hardware and software and their basic concept and configurations including policy, IPS, IDS etc.</p> <p>Switches: Basic Configuration with VLAN configuration etc.</p> <p>Load balancer: Basic configuration for sharing of traffics.</p> <p>Configurations of Network servers and their functionalities: DHCP, AAA, Proxy and others network management servers.</p> <p>Period Allocated: 3P</p>	<p>Passive components:</p> <p>UTP(Unshielded twisted pair), OFC (optical fiber cable), different types of network modules and their functions. Jack panel, Wire Manager, pigtail, LIU, patch chord, HDPE, jacket, connectors, raceways etc. The concept of bandwidth and its management. Tools and all types of commands for troubleshooting and rectification of network. Backup and restoration of all network devices.</p> <p>Period Allocated: 2P</p>	<p>Security: Fundamentals of Network Security, secure channels via encryption, Message Authentication codes, Authentication mechanism, Malware, Spyware, spam etc. Concept of endpoint security and gateway level security, Antivirus including.</p> <p>Period Allocated: 1P</p>
8.	Meteorological Communication Systems (5P)	<p>Data format: Study of All types of data format such as ASCII, Binary, BUFR, CREX, GRIB, HDF,NetCDF, CSV.</p> <p>Metadata: Basics of Metadata, Creation of</p>	<p>Global telecommunication Systems (GTS): Introduction of GTS and its hierarchical structure, AMSS, RTH, GISC, Aeronautical communication, AFTN OLBS,</p>	<p>WMO Procedure: WMO Information System (WIS), role and responsibilities of GISC, DCPC and NC.</p>

	<p>metadata from flat as well as through web interface in XML,KML etc., format.</p> <p>Period Allocated: 2P</p>	<p>VSAT.</p> <p>Period Allocated: 2P</p>	<p>WMO protocols, WMO Headers & Routing, WMO File naming convention.</p> <p>Period Allocated: 1P</p>
Learning Outcomes	<ol style="list-style-type: none"> 1. Describe and distinguish of analog modulation techniques. 2. Decide the appropriate modulation and demodulation technique for suitable transmitter and receiver circuit. 3. Gain awareness of the technologies of multiple access techniques i.e. TDMA, CDMA, FDMA etc. 4. Understanding of the Distinction between applications of different types of Antenna. 5. Gain insights into the concept of Networking and networking devices. 6. Understanding the architecture of GTS System. 		