Model Curriculum

QP Name: SATCOM Operation Technician

QP Code: TEL/Q6222

QP Version: 1.0

NSQF Level: 5

Model Curriculum Version: 1.0

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Training Parameters

Sector	Telecom
Sub-Sector	Passive Infrastructure
Occupation	Network Operation and Maintenance
Country	India
NSQF Level	5
Aligned to NCO/ISCO/ISIC Code	NCO-2015/3114.0701
Minimum Educational Qualification and Experience	Completed 2nd year of UG (UG Diploma) (of 3-years/4-years UG BE, B. Tech (Electrical/ Electronics & Instrumentation/ Mechanical, Civil Engineering)) **OR** Completed 2nd year diploma after 12th (in relevant field with 1 year of relevant experience) **OR** Completed 3-year diploma after 10th (in relevant field with 1 year of relevant experience) **OR** Previous relevant Qualification of NSQF Level (4 (Infrastructure Technician-5G Network, Technician 5G- Active Network Installation)) with 3 Years of experience
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18 Years
Last Reviewed On	NA
Next Review Date	31.01.2027
NSQC Approval Date	31.01.2024
QP Version	1.0
Model Curriculum Creation Date	31.01.2024
Model Curriculum Valid Up to Date	31.01.2027
Model Curriculum Version	1.0
Minimum Duration of the Course	570 hours
Maximum Duration of the Course	570 hours

Program Overview

This section summarizes the end objectives of the program along with its duration.

Training Outcomes

At the end of the program, the learner should have acquired the listed knowledge and skills to:

- Describe the process of designing and installing electrical infrastructure, including grounding and bonding systems, transformers, switchgear, and power distribution units, while adhering to industry standards and safety codes.
- Analyze power quality issues, calculate power-related parameters, and use monitoring equipment to ensure stable power distribution.
- Install an inverter system by choosing the appropriate capacity, selecting compatible batteries, and following safety precautions, ensuring a reliable power supply.
- Monitor and maintain batteries, inverters, and generators, including cleaning terminals, applying anti-corrosion grease, and setting up battery monitoring systems for optimal performance.

Compulsory Modules

The table lists the modules, their duration and mode of delivery.

NOS and Module Details	Theory Duration	Practical Duration	On-the-Job Training Duration (Mandatory)	On-the-Job Training Duration (Recommended)	Total Duration
Bridge Module	**10:00**	**20:00**	**00:00**	-	**30:00**
Module 1: Introduction to the role of a SATCOM operation technician	10:00	20:00	00:00	-	30:00
TEL/N6267: Install of Antenna at remote end and establish link **NOS Version-1.0** **NSQF Level- 5**	**30:00**	**30:00**	**30:00**	**-**	**90:00**
Module 2: Install of Antenna at remote end and establish link	30:00	30:00	30:00	-	90:00
TEL/N6268: Set up and Operate Ground Station **NOS Version-1.0** **NSQF Level- 5**	**10:00**	**20:00**	**30:00**	**-**	**60:00**
Module 3: Set up and Operate Ground Station	10:00	20:00	30:00	-	60:00

TEL/N6269: Signal Analysis, Ground Station Maintenance, and Security Implementation **NOS Version-1.0** **NSQF Level- 5**	**20:00**	**40:00**	**00:00**	**-**	**60:00**
Module 4: Signal Analysis, Ground Station Maintenance, and Security Implementation	20:00	40:00	00:00		60:00
TEL/N6270: Manage Network Operation Centre (NOC) or Hub **NOS Version-1.0** **NSQF Level- 5**	**30:00**	**30:00**	**30:00**	**-**	**90:00**
Module 5: Manage Network Operation Centre (NOC) or Hub	30:00	30:00	30:00	-	90:00
TEL/N6271: Incident management or PM Activity **NOS Version-1.0** **NSQF Level- 5**	**30:00**	**30:00**	**30:00**	**-**	**90:00**
Module 6: Incident management or PM Activity	30:00	30:00	30:00	-	90:00
TEL/N6272: Network Management, Performance Optimization and Testing **NOS Version-1.0** **NSQF Level- 5**	**10:00**	**20:00**	**30:00**	**-**	**60:00**
Module 7: Network Management, Performance Optimization and Testing	10:00	20:00	30:00	-	60:00
TEL/N9104: Manage Work, Resources and Safety at workplace **NOS Version-2.0** **NSQF Level- 5**	**10:00**	**20:00**	**00:00**	**-**	**30:00**
Module 8: Working effectively and optimizing resources for a safe work place	10:00	20:00	00:00	-	30:00
DGT/VSQ/N0102: Employability Skills (60 Hours) **NOS Version No. 1.0** **NSQF Level- 2**	**60:00**	**00:00**	**00:00**	**-**	**60:00**
Module 8: Employability Skills	60:00	00:00	00:00	-	60:00
Total Duration	**210:00**	**210:00**	**150:00**		**570:00**

Module Details

Module 1: Introduction to the role of SATCOM operation technician
Bridge Module

Terminal Outcomes:

- Discuss the job role of SATCOM operation technician.
- Explain the scope of work for SATCOM operation technician.

Duration: *10:00*	Duration: *20:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
- Describe the size and scope of the Telecom industry and its sub-sectors. - Discuss the role and responsibilities of a SATCOM operation technician. - Identify various employment opportunities for a SATCOM operation technician. - Discuss the organisational policies on workplace ethics, managing sites, quality standards, personnel management and public relations (PR). - Describe the process workflow in the organization and the role of SATCOM operation technician. - List the various daily, weekly, monthly operations/activities that take place at the site under SATCOM operation technician.	- Role play based on case studies, outlining the scope, responsibilities, and challenges of SATCOM operation technician. - Analyse the requirements for the course and prepare for the pre-requisites of the course.
Classroom Aids:	
Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films	
Tools, Equipment and Other Requirements	
NA	

Module 2: Install of Antenna at remote end and establish link
Mapped to NOS: TEL/N6267, v1.0

Terminal Outcomes:

- Identify and explain the tools and equipment required for a specific task.
- Assemble the antenna components accurately according to provided guidelines
- Install and configure the software correctly on the designated system
- Configure network settings, including IP address, subnet mask, and default gateway, to establish connectivity between devices
- Identify the system libraries and files required for the operation of a specific system

Duration: *30:00*	Duration: *30:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
- Identify the telnet tools and IPv4 settings in a laptop. - Review the necessary guidelines, including antenna assembly instructions, safety precautions, and specific requirements. - Collect the necessary tools for antenna assembly, such as wrenches, screwdrivers, cable cutters, crimping tools, etc. - Identify and familiarize with the various components of the antenna system, such as the reflector, feed assembly, mounting brackets, cables, and connectors. - Follow guidelines to mount the antenna on the designated structure or mount. - Explain the importance of proper grounding of the antenna system to minimize the risk of electrical hazards and protect against lightning strikes. - Describe the process of installing and configuring software according to the IDU (Indoor Unit-Modem). - Verify the connectivity between the IDU modem and the satellite network or other associated devices. - Explain the purpose of regularly monitoring the performance and health	- Assemble the antenna according to provided guidelines using prescribed tools. - Test and commission the antenna to ensure proper functionality. - Set up a clean and organized work area for antenna assembly. - Secure the antenna assembly properly using prescribed tools. - Attach cables to the appropriate connectors on the feed assembly and ensure secure fastening. - Use cable cutters, crimping tools, or other specified tools for cable termination or connector installation. - Use a torque wrench to tighten bolts and nuts to recommended torque values. - Double-check all connections, ensuring they are correctly installed and tightened. - Inspect the entire antenna assembly for any visible damage, loose components, or irregularities. - Physically connect the IDU modem to the computer or server using the appropriate interface (Ethernet, USB, serial connection).

of the IDU modem software.

- Define the master IP address and its role in the SATCOM network.

- Explain the steps to access and configure network settings for the IDU modem, including IP address, subnet mask, default gateway, and other parameters.

- Describe the process of checking for firmware or software updates for the IDU modem.

- Explain the steps to access the modem's configuration interface using a web browser.

- Describe the process of obtaining the master IP address and the various ways to connect a computer to the network.

- Install and configure software according to the IDU modem requirements.

- Perform tests to ensure proper signal acquisition, data transmission, and system functionality.

- Access the modem with the master IP in a web browser.

- Connect a computer to the network using an Ethernet cable or Wi-Fi connection.

- Apply IP assignment on a laptop or computer.

- Use a multimeter for voltage measurement during SATCOM operations.

Classroom Aids:
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop

Tools, Equipment and Other Requirements
Antenna components and assembly materials, Wrenches, Screwdrivers, Cable cutters, Crimping tools, Torque wrenches, Alignment tools, Multimeter, Network cables, Modem or gateway device, IDU modem, gloves, safety goggles, Documentation and manuals.

Module 3: Set up and Operate Ground Station
Mapped to NOS: TEL/N6268, v1.0

Terminal Outcomes:

- Understand the steps and requirements for installing and aligning a ground station antenna
- Perform accurate tracking and pointing of a ground station antenna towards a satellite to maintain a stable communication link
- Conduct maintenance tasks and inspections on ground station equipment to ensure proper functioning and reliability
- Monitor and analyze signal quality parameters using appropriate tools and equipment to optimize the performance of a communication link
- Implement appropriate security measures, such as access controls, encryption protocols, and intrusion detection systems, to protect the ground station and communication link

Duration: *10:00*	**Duration**: *20:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
- Define the key components and requirements of a ground station antenna system. - Explain the importance of proper antenna alignment and positioning for optimal signal reception and transmission. - Define the installation and alignment of the ground station antenna, thermal control system, power system, attitude and orbit control system. - Identify the different signal quality parameters and their significance in assessing the performance of a communication link. - Describe the principles and techniques involved in grounding and protecting the antenna system against electrical hazards and lightning strikes. - Discuss the importance of regular maintenance and inspections for ensuring the reliability and proper functioning of ground station equipment. - Explain the concept of satellite tracking and the factors involved in determining the azimuth and elevation angles for optimal signal reception. - Discuss the significance of calibration and	- Install and align a ground station antenna to achieve the required gain, polarization, and signal reception/transmission. - Determine the azimuth and elevation angles required to align the antenna with a specific satellite. - Use bubble levels or inclinometers to achieve precise positioning and levelness of the antenna. - Fine-tune the antenna's azimuth, elevation, and polarization adjustments using signal strength meters or receivers. - Verify the signal quality and strength using appropriate equipment such as spectrum analyzers or satellite signal meters. - Securely fasten mounting brackets, bolts, and nuts to ensure the stability and alignment of the antenna over time. - Establish proper grounding for the antenna system, following local electrical codes and safety guidelines. - Track and point the antenna towards the satellite, maintaining precise azimuth and elevation angles for a stable communication link.

accuracy in antenna tracking systems and indicators.

- Outline the steps involved in selecting an appropriate location for a ground station antenna to ensure a clear line of sight to the satellite.

- Describe the role of tracking software and mechanisms in maintaining a stable communication link with the satellite.

- Explain the importance of access controls, encryption protocols, and intrusion detection systems in securing the ground station and communication link against unauthorized access and cyber threats.

- Discuss the need for updating software, firmware, and operating systems to address security vulnerabilities and protect against potential attacks.

- Outline the key elements of an incident response plan and backup/disaster recovery procedures for effective handling of security incidents or system failures.

- Describe the role of continuous monitoring tools in tracking and analyzing network activity, system logs, and security events in real-time.

- Verify the accuracy and calibration of azimuth and elevation indicators on the antenna and tracking system.

- Perform functional tests on the ground station equipment to ensure proper functioning and alignment.

- Monitor and analyze signal quality parameters such as SNR, BER, and C/N to optimize the performance of the communication link.

- Use appropriate tools and equipment to measure signal quality parameters and connect them to the ground station setup.

- Keep monitoring equipment running to continuously monitor signal quality parameters during operation.

- Maintain records of measured signal quality parameters at regular intervals.

- Analyze the recorded data to assess signal quality parameters over time.

- Implement security measures such as access controls, encryption protocols, and intrusion detection systems to protect the ground station and communication link from unauthorized access and cyber threats.

- Configure intrusion detection and prevention systems to detect and mitigate potential security breaches or unauthorized activities.

- Update access control policies to align with evolving security requirements.

- Install firewalls to enforce network security policies and control traffic entering and leaving the ground station network.

- Update and patch software, firmware, and operating systems used in the ground station setup to address security vulnerabilities.

- Develop an incident response plan outlining the steps to be taken in the

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	event of a security breach or cyber-attack.
	• Establish backup and disaster recovery procedures to ensure timely recovery and continuity of operations in case of a security incident or system failure.
	• Implement continuous monitoring tools to track and analyze network activity, system logs, and security events in real-time.

Classroom Aids:

Training Kit (Trainer **G**uide, Presentations). Whiteboard, Marker, Projector, Laptop

Tools, Equipment and Other Requirements

Network cables, electrical wires, alarms, indicators, tools and equipment, AC, DG, PIU, SMPS and battery bank, Auto Man Failure (AMF) panel, alarm panel, tools like pliers, power drill, screwdrivers, spanner, measurement tools, like multi-meter and thermometer, diagnostic tools, Sample of preventive and corrective maintenance formats and checklists Laptop with software such as MS Office and CRM

Module 4: Signal Analysis, Ground Station Maintenance, and Security Implementation
Mapped to NOS: TEL/N6269, v1.0

Terminal Outcomes:

Duration: *20:00*	Duration: *40:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Recall the signal quality parameters, including Signal-to-Noise Ratio (SNR), Bit Error Rate (BER), and Carrier-to-Noise Ratio (C/N).	• Keep monitoring equipment running to continuously monitor signal quality parameters during operation.
• Identify the tools and equipment used for measuring signal quality parameters in a ground station setup.	• Conduct regular maintenance and inspections of ground station equipment, including antenna, feed system, and tracking mechanisms.
• List the key components of a ground station, such as the antenna, feed system, and tracking mechanisms.	• Check tracking mechanisms, such as azimuth and elevation systems, for proper calibration.
• Understand the significance of maintaining a record of measured signal quality parameters at regular intervals.	• Inspect cables and connectors for signs of damage, wear, or loose connections.
• Describe the process of connecting monitoring equipment to relevant points in a ground station setup.	• Configure the IDPS to detect and alert on suspicious network events, such as unauthorized access attempts or abnormal traffic patterns.
• Utilize appropriate tools and equipment to measure and assess signal quality parameters in a practical setting.	• Install firewalls to enforce network security policies and control traffic entering and leaving the ground station network.
• Demonstrate the steps involved in conducting functional tests on ground station equipment.	• Develop backup and disaster recovery procedures for timely recovery and continuity of operations in case of a security incident or system failure.
• Evaluate the impact of maintenance and inspection on the proper functioning and reliability of ground station equipment.	• Implement continuous monitoring tools to track and analyze network activity, system logs, and security events in real-time.
• Compare different security measures and their effectiveness in protecting a ground station from unauthorized access and cyber threats.	
• Assess the alignment of access control policies with evolving security requirements.	
• Critically review incident response plans and backup procedures for their	

adequacy in handling security incidents.

- Design access levels and user roles based on job responsibilities and the principle of least privilege.

- Formulate an incident response plan outlining the steps to be taken in the event of a security breach or cyber-attack.

Classroom Aids:

Training Kit (Trainer **G**uide, Presentations). Whiteboard, Marker, Projector, Laptop

Tools, Equipment and Other Requirements

Network cables, electrical wires, alarms, indicators, tools and equipment, AC, DG, PIU, SMPS and battery bank, Auto Man Failure (AMF) panel, alarm panel, tools like pliers, power drill, screwdrivers, spanner, measurement tools, like multi-meter and thermometer, diagnostic tools, Sample of preventive and corrective maintenance formats and checklists Laptop with software such as MS Office and CRM

Module 5: Manage Network Operation Centre (NOC) or Hub
Mapped to NOS: TEL/N6270, v1.0

Terminal Outcomes:

- Successfully implement and manage gateway ID within a network infrastructure
- Analyze and troubleshoot data connectivity issues and optimize signal strength for improved network performance
- Conduct performance analysis and testing to evaluate and optimize network performance
- Effectively manage and monitor databases within a network infrastructure
- Configure and manage network components to ensure optimal network performance and reliability
- Select appropriate antennas and transceivers based on specific network requirements and conditions

Duration: *30:00*	Duration: *30:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
- Define the concept of gateway ID and its significance in a SATCOM network. - Explain the purpose of assigning unique gateway IDs to SATCOM gateways. - Describe the format and structure of a gateway ID in a SATCOM network. - Discuss the integration of gateway ID information into Network Management Systems (NMS) or operations support systems. - Discuss the role of gateway IDs in monitoring performance and troubleshooting issues with SATCOM gateways. - Describe the security measures that should be incorporated into the gateway ID implementation. - Explain the process of creating a site-code or folder for organizing SATCOM-related data. - Explain the testing process for data connectivity and ensuring strong satellite signal strength. - Discuss the alignment process of satellite antennas to ensure accurate pointing towards the desired satellite.	- Implement the assignment of unique gateway IDs to SATCOM gateways in a network. - Integrate gateway ID information into Network Management Systems (NMS) or operations support systems. - Implement configuration management processes to track and manage changes to gateway IDs. - Utilize gateway IDs to monitor performance and troubleshoot issues with SATCOM gateways. - Create a site-code or folder for organizing SATCOM-related data. - Store data in internal and external storage systems. - Test data connectivity and ensure strong satellite signal strength for reliable transmission. - Use satellite signal meters or spectrum analyzers to measure signal strength and confirm compliance with specifications. - Check the alignment of satellite antennas to ensure accurate pointing towards desired satellites. - Perform a link budget analysis to assess

- Explain the link budget analysis and its role in assessing the expected performance of a satellite link.

- Discuss the setup of a test environment with necessary equipment for SATCOM operations.

- Explain the use of specialized network testing tools or software to generate traffic and measure data transfer rates.

- Discuss the purpose and process of ping or latency tests for measuring round-trip time.

- Explain the monitoring process for data connections and measuring error rate and bit error rate (BER).

- Describe the simulation of link failures or switchovers to verify data connectivity.

- Discuss the field testing process for assessing data connectivity under varying conditions.

- Explain the database schema design for SATCOM operations and its specific requirements.

- Discuss the creation of a relational database using a database management system (DBMS) and importing relevant data.

- Explain the utilization of Network Management Systems (NMS) to monitor and manage the SATCOM network.

- Describe the collection and analysis of performance data using the database and NMS.

- Discuss the implementation of fault management features within the NMS for anomaly detection and response.

- Explain the use of the database for storing and managing configurations of SATCOM devices.

- Discuss the application of commands to query data from the database.

- the expected performance of a satellite link.

- Use specialized network testing tools or software to generate traffic and measure data transfer rates.

- Perform ping or latency tests to measure round-trip time for data packets.

- Monitor data connections for errors or anomalies using appropriate tools to measure error rate and bit error rate (BER).

- Simulate link failures or switchovers and verify the continuity of data connectivity.

- Configure IP addresses, ensuring no overlap or conflicts, and determine subnet masks for each subnet.

- Set up network monitoring tools to monitor performance, availability, and security of the SATCOM network.

- Configure DHCP (Dynamic Host Configuration Protocol) for IP address allocation.

- Configure SATCOM devices with their respective static IP addresses, subnet masks, and other network parameters.

- Assign LAN IP addresses and provide network names.

- Configure NATing (Network Address Translation) for address translation between private and public networks.

- Monitor Rx and TX of the remote site at regular intervals.

- Control data rate or data packages as required.

- Backup NMS for data protection and disaster recovery.

- Add routes on specific routing tables as needed.

- Choose appropriate antennas with high gain and narrow beam width for improved RX and TX signals.

- Conduct thorough frequency planning to

	select suitable frequencies for SATCOM operations.
	• Analyze interference patterns and ensure compatibility with the desired satellite system.

Classroom Aids:

Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop

Tools, Equipment and Other Requirements

Computer or Laptop, Projector or Smartboard, Internet connectivity, Network performance Measurement and analysis tools, Spectrum analyzers, Network simulation software, Base station equipment, Antennas, Routers, User Equipment (UE), Radio Access Network (RAN) equipment, Intelligent Controller (RIC), Service Management and Orchestration (SMO) solution, Components of 5G Service-Based Architecture (SBA), Network Function Virtualization (NFV) components, Virtual Infrastructure for hosting VNFs, Frequency band allocation tools, Network integration tools, Network monitoring and analytics tools, Troubleshooting equipment, Simulation environment or lab setup for practical exercises

Module 6: Incident management or PM Activity
Mapped to NOS: TEL/N6271, v1.0

Terminal Outcomes:

- Understand the principles and techniques of down call analysis in a network
- Measure and optimize signal strength, ensuring accurate antenna alignment for optimal network performance
- Configure and monitor network components to ensure efficient and secure network operations
- Conduct performance analysis and testing to evaluate network performance, identify bottlenecks, and optimize network operations
- Effectively utilize databases and NMS tools for network monitoring, troubleshooting, and optimization
- Understand the role of industry associations in network testing and standardization

Duration: 30:00	Duration: 30:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
- Explain the factors that can cause a down call in a SATCOM system. - Describe the types of SATCOM equipment that may contribute to a down call and their functions. - Analyze potential sources of interference in a SATCOM system, including adjacent satellites, other communication systems, and electromagnetic interference. - Discuss the use of diagnostic tools or software to perform tests such as ping tests, latency measurements, or bit error rate (BER) calculations to identify the cause of a down call. - Explain the importance of assessing satellite signal strength and alignment of the satellite antenna in troubleshooting a down call. - Describe the process of performing a link budget analysis to assess the expected performance of a satellite link. - Discuss the significance of network configuration, including IP addresses, subnet masks, routing tables, and NATing settings, in troubleshooting a down call. - Explain the use of network monitoring tools to analyze network traffic and	- Examine SATCOM equipment for signs of malfunction or failure in troubleshooting a down call. - Inspect transceivers, modems, routers, or other components that may contribute to a down call. - Utilize diagnostic tools or software to perform tests such as ping tests, latency measurements, or bit error rate (BER) calculations to pinpoint the cause of a down call. - Assess satellite signal strength using a satellite signal meter or spectrum analyzer to ensure it meets required specifications. - Confirm the alignment of the satellite antenna to ensure it is accurately pointing towards the desired satellite. - Perform a link budget analysis to assess the expected performance of the satellite link. - Analyze network configuration, including IP addresses, subnet masks, routing tables, and NATing settings, to troubleshoot a down call. - Utilize network monitoring tools to analyze network traffic and identify

identify abnormal patterns, packet loss, or congestion.	abnormal patterns, packet loss, or congestion.
• Describe the importance of verifying data connectivity and monitoring the data connection for errors or anomalies in troubleshooting a down call.	• Verify data connectivity between the SATCOM gateway and remote locations.
• Discuss the value of conducting field tests at different locations within the coverage area to assess data connectivity under varying conditions.	• Monitor the data connection for errors or anomalies.
	• Conduct field tests at different locations within the coverage area to assess data connectivity under varying conditions.
• Explain the role of a database management system (DBMS) and network management system (NMS) in collecting and analyzing performance data.	• Utilize a database management system (DBMS) and network management system (NMS) to collect and analyze performance data.
• Describe the industry associations and standards that govern SATCOM operations, such as the International Telecommunication Union (ITU), Global VSAT Forum (GVF), or Satellite Industry Association (SIA).	• Monitor signal strength, link utilization, latency, and throughput to identify anomalies or areas for improvement. • Perform testing of SATCOM accessories to ensure proper functioning and compatibility.

Classroom Aids:

Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop

Tools, Equipment and Other Requirements

Computer or Laptop, Projector or Smartboard, Internet connectivity, Network Performance Measurement and Analysis Tools, Network Access Control Mechanisms, Firewalls, Intrusion Detection/Prevention Systems (IDS/IPS), Content Filtering Mechanisms, Traffic Analysis Tools, Anomaly Detection Systems, Monitoring Equipment for 5G NR Physical Channels and Signals, Signal Capture Equipment, Frequency Analysis Tools, Error Handling Mechanisms, Channel Estimation and Equalization Tools, Demodulation and Decoding Tools, Analog Beamforming Equipment, Digital Beamforming Equipment, Monitoring Equipment for Beamforming Reconstruction, Beamforming Configuration Tools.

Module 7: Network Management, Performance Optimization and Testing
Mapped to NOS: TEL/N6272, v1.0

Terminal Outcomes:

- Define and implement network configurations, including IP addresses, subnet masks, routing tables, and NATing settings.
- Utilize monitoring tools to differentiate between normal and abnormal patterns in network traffic.
- Explain the role of industry associations, such as the International Telecommunication Union (ITU), Global VSAT Forum (GVF), or Satellite Industry Association (SIA), in the satellite communication sector.
- Utilize a Database Management System (DBMS) to collect and organize performance data.
- Employ a Network Management System (NMS) to analyze performance data and make informed decisions.

Duration: *10:00*	**Duration**: *20:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
- Define the components of network configuration, including IP addresses, subnet masks, routing tables, and NATing settings. - Explain the purpose and significance of monitoring tools in analyzing network traffic. - Describe the process of conducting field tests to assess data connectivity under varying conditions. - Differentiate between normal and abnormal patterns in network traffic. - Interpret the results of a link budget analysis and its impact on satellite communication performance. - Explain the role of industry associations like the International Telecommunication Union (ITU) and the Global VSAT Forum (GVF) in the satellite communication sector. - Apply troubleshooting techniques to identify and resolve errors or anomalies in a monitored data connection. - Utilize specialized network testing tools or software to generate traffic and measure data transfer rates.	- Use monitoring tools to analyze network traffic and identify abnormal patterns, high packet loss, or congestion. - Perform a link budget analysis to assess the expected performance of a satellite link. - Conduct field tests at different locations within a coverage area to assess data connectivity under varying conditions. - Simulate link failures or switchovers to verify the maintenance of data connectivity without significant interruptions. - Utilize a Database Management System (DBMS) to collect and organize performance data. - Employ a Network Management System (NMS) to analyze performance data and make informed decisions. - Monitor signal strength, link utilization, latency, and throughput using appropriate tools to identify areas for improvement. - Generate traffic and measure data transfer rates using specialized network testing tools or software. - Inspect industry associations such as the

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• Demonstrate the simulation of link failures or switchovers to verify continuous data connectivity.	International Telecommunication Union (ITU), Global VSAT Forum (GVF), or Satellite Industry Association (SIA) to understand their roles in the satellite communication industry. • Perform practical testing of SATCOM accessories to assess their functionality and compatibility with the communication system.

Classroom Aids:

Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop

Tools, Equipment and Other Requirements

Computer or Laptop, Projector or Smartboard, Internet connectivity, Network Performance Measurement and Analysis Tools, Network Access Control Mechanisms, Firewalls, Intrusion Detection/Prevention Systems (IDS/IPS), Content Filtering Mechanisms, Traffic Analysis Tools, Anomaly Detection Systems, Monitoring Equipment for 5G NR Physical Channels and Signals, Signal Capture Equipment, Frequency Analysis Tools, Error Handling Mechanisms, Channel Estimation and Equalization Tools, Demodulation and Decoding Tools, Analog Beamforming Equipment, Digital Beamforming Equipment, Monitoring Equipment for Beamforming Reconstruction, Beamforming Configuration Tools.

Module 8: Working effectively and optimizing resources for a safe workplace
Mapped to NOS: TEL/N9104, v2.0

Terminal Outcomes:

- Plan work effectively, implement safety practices and optimize use of resources
-

Duration: *10:00*	Duration: *20:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
- List the importance of following the standard operating procedures of the company w.r.t. privacy, confidentiality and security. - List the key performance indicators for the new tasks. - Identify the opportunities for team building workshops and motivational trainings. - List and explain work requirements to be followed by the team. - Identify the issues with and handle them. - Discuss correct way to show emotions at workplace. - Describe the importance of timely completion of tasks. - Explain the importance of escalation matrix. - Explain the importance of providing and receiving feedback constructively. - Analyse ways to optimize usage of resources. - List the importance, cause and effect of greening of jobs. - Identify different types of hazards such as illness, accidents, fires etc. - List the causes of risks and potential hazards in a work area and ways to prevent them. - List the steps to report accident and health related issues as per SOP. - Explain the concept of waste	- Demonstrate techniques to save on cost and time. - Demonstrate routine cleaning of tools, equipment and machines to ensure team follows the same. - Use resources such as water judiciously. - Check for malfunctions in equipment and report as per SOP. - Report any breaches in safety and security to the concerned person. - Illustrate ways to keep work area clean such as mopping spills and leaks, cleaning grease stains etc. - Check for spills and leaks and plug the same. - Demonstrate segregation of types of hazardous waste. - Illustrate steps to minimize waste. - Illustrate proper waste disposal procedures and how to dispose-off hazardous waste. - Illustrate ways to find exact cause of a problem and validate the same in case done by a team member.

management.	
• List the methods of waste disposal.	
• Identify the different categories of waste for the purpose of segregation.	
• Differentiate between recyclable and non- recyclable waste.	
• List electronic waste disposal procedures.	

Classroom Aids:

White board/ black board marker / chalk, duster, computer or Laptop attached to LCD projector

Tools, Equipment and Other Requirements

Personal Protection Equipment: safety glasses, head protection, rubber gloves, safety footwear, warning signs and tapes, fire extinguisher and first aid kit

Mandatory Duration: 60:00

Location: On-Site

S.No.	Module Name	Key Learning Outcomes	Duration(hours)
1.	Introduction to Employability Skills	• Discuss the Employability Skills required for jobs in various industries • List different learning and employability related GOI and private portals and their usage	1.5 Hours
2.	Constitutional values - Citizenship	• Explain the constitutional values, including civic rights and duties, citizenship, responsibility towards society and personal values and ethics such as honesty, integrity, caring and respecting others that are required to become a responsible citizen • Show how to practice different environmentally sustainable practices.	1.5 Hours
3.	Becoming a Professional in the 21st Century	• Discuss 21st century skills. • Display positive attitude, self - motivation, problem solving, time management skills and continuous learning mindset in different situations.	1 Hours
4.	Basic English Skills	• Use appropriate basic English sentences/phrases while speaking	2 Hours
5.	Communication Skills	• Demonstrate how to communicate in a well - mannered way with others. • Demonstrate working with others in a team	4 Hour
6.	Diversity & Inclusion	• Show how to conduct oneself appropriately with all genders and PwD • Discuss the significance of reporting sexual harassment issues in time	1 Hour
7.	Financial and Legal Literacy	• Discuss the significance of using financial products and services safely and securely. • Explain the importance of managing expenses, income, and savings. • Explain the significance of approaching the concerned authorities in time for any exploitation as per legal rights and laws	4 Hours

8.	Essential Digital Skills	• Show how to operate digital devices and use the associated applications and features, safely and securely • Discuss the significance of using internet for browsing, accessing social media platforms, safely and securely	3 Hours
9.	Entrepreneurship	• Discuss the need for identifying opportunities for potential business, sources for arranging money and potential legal and financial challenges	7 Hours
10.	Customer Service	• Differentiate between types of customers • Explain the significance of identifying customer needs and addressing them • Discuss the significance of maintaining hygiene and dressing appropriately	4 Hours
11.	Getting ready for apprenticeship & Jobs	• Create a biodata • Use various sources to search and apply for jobs • Discuss the significance of dressing up neatly and maintaining hygiene for an interview • Discuss how to search and register for apprenticeship opportunities	2 Hours

LIST OF TOOLS & EQUIPMENT FOR EMPLOYABILITY SKILLS

S. No.	Name of the Equipment	Quantity
1.	Computer (PC) with latest configurations – and Internet connection with standard operating system and standard word processor and worksheet software (Licensed) (all software should either be latest version or one/two version below)	As required
2.	UPS	As required
3.	Scanner cum Printer	As required
4.	Computer Tables	As required
5.	Computer Chairs	As required
6.	LCD Projector	As required
7.	White Board 1200mm x 900mm	As required
Note: Above Tools &Equipment not required, if Computer LAB is available in the institute.		

Module 10: On-the-Job Training

Mapped to SATCOM Operation Technician

Mandatory Duration: *150:00*	Recommended Duration: *00:00*
Module Name: On-the-Job Training **Location: On Site**	

Terminal Outcomes

1. Assemble the antenna according to provided guidelines using prescribed tools.

2. Test and commission the antenna to ensure proper functionality.

3. Set up a clean and organized work area for antenna assembly.

4. Secure the antenna assembly properly using prescribed tools.

5. Attach cables to the appropriate connectors on the feed assembly and ensure secure fastening.

6. Use cable cutters, crimping tools, or other specified tools for cable termination or connector installation.

7. Use a torque wrench to tighten bolts and nuts to recommended torque values.

8. Double-check all connections, ensuring they are correctly installed and tightened.

9. Inspect the entire antenna assembly for any visible damage, loose components, or irregularities.

10. Physically connect the IDU modem to the computer or server using the appropriate interface (Ethernet, USB, serial connection).

11. Install and configure software according to the IDU modem requirements.

12. Perform tests to ensure proper signal acquisition, data transmission, and system functionality.

13. Access the modem with the master IP in a web browser.

14. Connect a computer to the network using an Ethernet cable or Wi-Fi connection.

15. Apply IP assignment on a laptop or computer.

16. Use a multimeter for voltage measurement during SATCOM operations.

Annexure

Trainer Requirements

<table>
<tr><td colspan="7" align="center">Trainer Prerequisites</td></tr>
<tr><td rowspan="2">Minimum Educational Qualification</td><td rowspan="2">Specialization</td><td colspan="2">Relevant Industry Experience</td><td colspan="2">Training Experience</td><td rowspan="2">Remarks</td></tr>
<tr><td><i>Years</i></td><td><i>Specialization</i></td><td><i>Years</i></td><td><i>Specialization</i></td></tr>
<tr><td>Graduate</td><td>Science/Electronics / Telecom/IT and other relevant domains</td><td>3</td><td>SATCOM Operations</td><td>0</td><td>NA</td><td>Eligible for ToT program</td></tr>
</table>

<table>
<tr><td colspan="2" align="center">Trainer Certification</td></tr>
<tr><td align="center">Domain Certification</td><td align="center">Platform Certification</td></tr>
<tr><td>Job Role "SATCOM Operation Technician", "TEL/Q6222, v1.0", Minimum accepted score is 80%.</td><td>Trainer is certified for the job role "Trainer (VET & SKILLS)"; mapped to Qualification Pack: - "MEP/Q2601, v2.0" with minimum 80% of score.</td></tr>
</table>

Assessor Requirements

Assessor Prerequisites					
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training/Assessment Experience		Remarks
		Years	Specialization	Years	Specialization	
Graduate	Science/Electronics/ Telecom/IT and other relevant domains	3	SATCOM Operations	0	NA	Eligible for ToA program

Assessor Certification	
Domain Certification	**Platform Certification**
Job Role "**SATCOM Operation Technician**", "TEL/Q6222, v1.0", Minimum accepted score is 80%.	Trainer is certified for the job role **"Trainer (VET & SKILLS)"**; mapped to Qualification Pack: - "MEP/Q2701, v2.0" with minimum 80% of score.

Trainer Requirements (Employability Skills 60 hours)

Trainer Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
Graduate/CITS	Any discipline			2	Teaching experience	Prospective ES trainer should:
Current ITI trainers	Employability Skills Training (3 days full-time course done between 2019-2022)					• have good communication skills • be well versed in English
Certified current EEE trainers (155 hours)	from Management SSC (MEPSC)					• have digital skills • have attention to detail
Certified Trainer	Qualification Pack: Trainer					• be adaptable • have willingness to learn

Trainer Certification	
Domain Certification	**Platform Certification**
Certified in 30-hour Employability NOS (2022), with a minimum score of 80% OR Certified in 120- OR 90- OR 60-hour Employability NOS (2022), with a minimum score of 80%	NA

Master Trainer Requirements (Employability Skills 60 hours)

Master Trainer Prerequisites						
Minimum Educational Qualification	**Specialization**	**Relevant Industry Experience**		**Training Experience**		**Remarks**
		Years	**Specialization**	**Years**	**Specialization**	
Graduate/CITS	Any discipline			3	Employability Skills curriculum training experience with an interest to train as well as orient other peer trainers	Prospective ES trainer should: • have good communication skills • be well versed in English • have digital skills • have attention to detail • be adaptable • have willingness to learn
Certified Master Trainer	Qualification Pack: Master Trainer			3	EEE training of Management SSC (MEPSC) (155 hours)	

Master Trainer Certification	
Domain Certification	**Platform Certification**
Certified in 30-hour Employability NOS (2022), with a minimum score of 90%. OR Certified in 120- OR 90- OR 60-hour Employability NOS (2022), with a minimum score of 90%	NA

Assessment Strategy

1. Assessment System Overview:
   - Batches assigned to the assessment agencies for conducting the assessment on SDSM/SIP or email.
   - Assessment agencies send the assessment confirmation to VTP/TC looping SSC.
   - The assessment agency deploys the ToA certified Assessor for executing the assessment.
   - SSC monitors the assessment process & records.

2. Testing Environment:
   - Confirm that the centre is available at the same address as mentioned on SDMS or SIP.
   - Check the duration of the training.
   - Check the Assessment Start and End time to be as 10 a.m. and 5 p.m.
   - If the batch size is more than 30, then there should be 2 Assessors.
   - Check that the allotted time to the candidates to complete Theory & Practical Assessment is correct.
   - Check the mode of assessment—Online (TAB/Computer) or Offline (OMR/PP).
   - Confirm the number of TABs on the ground are correct to execute the Assessment smoothly.
   - Check the availability of the Lab Equipment for the particular Job Role.

3. Assessment Quality Assurance levels / Framework:
   - Question papers created by the Subject Matter Experts (SME).
   - Question papers created by the SME verified by the other subject Matter Experts.
   - Questions are mapped with NOS and PC.
   - Question papers are prepared considering that level 1 to 3 are for the unskilled & semi- skilled individuals, and level 4 and above are for the skilled, supervisor & higher management.
   - An assessor must be ToA certified & the trainer must be ToT Certified.
   - The assessment agency must follow the assessment guidelines to conduct the assessment.

4. Types of evidence or evidence-gathering protocol:
   - Time-stamped & geotagged reporting of the assessor from assessment location.
   - Center photographs with signboards and scheme-specific branding.
   - Biometric or manual attendance sheet (stamped by TP) of the trainees during the training period.
   - Time-stamped & geotagged assessment (Theory + Viva + Practical) photographs & videos.

5. Method of verification or validation:
   - A surprise visit to the assessment location.
   - A random audit of the batch.
   - Random audit of any candidate.

6. Method for assessment documentation, archiving, and access:
- Hard copies of the documents are stored.
- Soft copies of the documents & photographs of the assessment are uploaded / accessed from Cloud Storage.
- Soft copies of the documents & photographs of the assessment are stored in the Hard Drives.

Assessment Strategy (Employability Skills 60 hours)

The trainee will be tested for the acquired skill, knowledge and attitude through formative/summative assessment at the end of the course and as this NOS and MC is adopted across sectors and qualifications, the respective AB can conduct the assessments as per their requirements.

References

Glossary

Term	Description
Declarative Knowledge	Declarative knowledge refers to facts, concepts and principles that need to be known and/or understood in order to accomplish a task or to solve a problem.
Key Learning Outcome	A key learning outcome is a statement of what a learner needs to know, understand and be able to do in order to achieve the terminal outcomes. A set of key learning outcomes will make up the training outcomes. Training outcome is specified in terms of knowledge, understanding (theory) and skills (practical application).
OJT (M)	On-the-job training (Mandatory); trainees are mandated to complete specified hours of training on-site
OJT (R)	On-the-job training (Recommended); trainees are recommended the specified hours of training on-site
Procedural Knowledge	Procedural knowledge addresses how to do something, or how to perform a task. It is the ability to work or produce a tangible work output by applying cognitive, affective or psychomotor skills.
Training Outcome	Training outcome is a statement of what a learner will know, understand and be able to do upon the completion of the training.
Terminal Outcome	The terminal outcome is a statement of what a learner will know, understand and be able to do upon the completion of a module. A set of terminal outcomes help to achieve the training outcome.

Acronyms and Abbreviations

Term	Description
NOS	National Occupational Standard (s)
NSQF	National Skills Qualifications Framework
OJT	On-the-job Training
QP	Qualifications Pack
PwD	People with Disability
PPE	Personal Protective Equipment