

Qualification Pack



5G System Integrator

QP Code: TEL/Q4202

Version: 1.0

NSQF Level: 5

Telecom || 3rd Floor, Plot No 126, Sector - 44
Gurgaon - 122003 || email:QAteam@tsscindia.com



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TEL/Q4202: 5G System Integrator

Brief Job Description

5 G System Integrator is responsible for designing, implementing, and maintaining 5 G network. The individual collaborates with cross-functional teams to develop and optimize network solutions, ensuring high-speed connectivity, low latency, and reliable performance. Their duties include planning network architecture, troubleshooting network issues, conducting system testing, and staying updated with emerging 5 G technologies. They also play a crucial role in enabling the deployment and efficient operation of 5 G networks to support the evolving demands of the telecommunications industry.

Personal Attributes

The role of 5G system Integrator requires the individual to have a diverse set of problem-solving talents, flexibility, and effective communication skills. They need to be creative, detail-oriented, and able to keep up with the most recent advancements in the industry. Additionally, the deployment and upkeep of 5G networks require excellent coordination with cross-functional teams, which calls for cooperation and collaboration abilities.

Applicable National Occupational Standards (NOS)

Compulsory NOS:

1. [TEL/N4205: Set Standards for 5G Network Architecture](#)
2. [TEL/N4206: Verify and Prepare Hardware Equipment for 5G Installation](#)
3. [TEL/N4207: Design Spectrum and 5G Network Architecture](#)
4. [TEL/N4208: Implement the 5G New Radio \(NR\) and Radio Access](#)
5. [DGT/VSQ/N0102: Employability Skills \(60 Hours\)](#)

Qualification Pack (QP) Parameters

Sector	Telecom
Sub-Sector	Passive Infrastructure
Occupation	Network (Passive) Installation
Country	India
NSQF Level	5

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Credits	19
Aligned to NCO/ISCO/ISIC Code	NCO-2015/2153.0400
Minimum Educational Qualification & Experience	<p>Completed 2nd year of UG (UG Diploma) (Completed 2nd year of 3-years/4-years UG (Electronics/Telecom/IT and other relevant domains) with No Experience required)</p> <p>OR</p> <p>Pursuing 2nd year of UG (Pursuing 2nd year of 3-years/4-years UG (Electronics/Telecom/IT and other relevant domains) and continuing education with No Experience required)</p> <p>OR</p> <p>Completed 1st year of UG (UG Certificate) (Completed 1st year of 3-years/4-years UG (Electronics/Telecom/IT and other relevant domains) with One year of Experience required)</p> <p>OR</p> <p>Completed 3 year diploma after 10th (Completed 3-year diploma (Electronics/ Telecom/IT and other relevant domains) after 10 with One year of Experience required)</p> <p>OR</p> <p>12th grade Pass with 2 Years of experience</p>
Minimum Level of Education for Training in School	12th Class
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18 Years
Last Reviewed On	NA
Next Review Date	31/08/2026
NSQC Approval Date	31/08/2023
Version	1.0
Reference code on NQR	QG-05-TL-00930-2023-V1-TSSC
NQR Version	1

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TEL/N4205: Set Standards for 5G Network Architecture

Description

The 5G Network Evolution and Standards refers to the continuous development and adoption of technologies and protocols to enhance network performance and interoperability.

Scope

The scope covers the following :

- Implement new networking technologies and protocols
- Network performance, scalability, and reliability

Elements and Performance Criteria

Implement new networking technologies and protocols

To be competent, the user/individual on the job must be able to:

- PC1.** define the technical specifications for 5G network elements, including base stations (gNB), core network components, and user equipment
- PC2.** determine the frequency bands to be used for the IMT-2020 deployment.
- PC3.** allocate and specify the frequency bands to be used for 5G deployment, considering spectrum availability and compatibility
- PC4.** install the necessary infrastructure equipment, including base stations, Radio Access Network (RAN), and core network elements such as the serving and gateway
- PC5.** configure the RAN elements, including the base stations, eNodeB-EPC (Evolve Packet Core) and RNCs (Radio Network Controllers) or gNodeB.
- PC6.** perform network planning activities to design the coverage and capacity of the network
- PC7.** implement subscriber authentication and security mechanisms.
- PC8.** enable specific services and features, such as voice calls, data services, messaging, and multimedia services
- PC9.** perform testing and optimization activities to verify the network's performance and fine-tune the configuration parameters
- PC10.** analyse performance requirements for 5G networks, such as data rates, latency, and reliability, to ensure high-quality service delivery

Network performance, scalability, and reliability

To be competent, the user/individual on the job must be able to:

- PC11.** evaluate the current capacity of your network infrastructure and identify the areas where scalability is required
- PC12.** analyze the traffic patterns and trends to understand the growth in network demand
- PC13.** develop interoperability standards to ensure seamless communication between different vendors' equipment and network elements
- PC14.** determine if the existing hardware and equipment can support the increased traffic demands
- PC15.** implement network monitoring and analytics tools to continuously monitor network performance

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- PC16.** identify and troubleshoot network issues, such as latency, packet loss, and throughput
- PC17.** implement Quality of Service (QoS) mechanisms to prioritize critical services and applications, ensuring a consistent and reliable user experience
- PC18.** address regulatory aspects, including compliance with local and international telecommunications regulations and spectrum allocation policies

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

- KU1.** principles/fundamentals of 5G technology, including beamforming, massive MIMO, and network slicing
- KU2.** ITU's IMT-2020 framework and the specific frequency bands designated for 5G deployment
- KU3.** three (3) GPP standards that define the technical specifications for 5G network elements and protocols
- KU4.** detailed configuration and deployment procedures for base stations, RAN, and core network components
- KU5.** different authentication methods like SIM-based authentication, AKA, and EAP methods for securing subscribers
- KU6.** service-based architecture (SBA) and network function virtualization (NFV) for service delivery in 5G networks
- KU7.** techniques for planning network coverage and capacity, including cell placement and interference management
- KU8.** encryption methods, secure key exchange, and authentication protocols for network security
- KU9.** implementation of voice over 5G (VoNR), IoT connectivity, and multimedia services in 5G networks
- KU10.** drive testing, field measurements, and KPI analysis
- KU11.** QoS mechanisms like bearer control, flow control, and resource reservation in 5G networks
- KU12.** three (3)GPP Release 15, 16, and beyond, for seamless integration
- KU13.** monitoring tools like SNMP, NetFlow, and Deep Packet Inspection (DPI)
- KU14.** techniques to analyze traffic patterns, predict user demand, and adapt the network accordingly
- KU15.** hardware requirements for RAN and core network elements, considering future scalability
- KU16.** latency targets and throughput expectations
- KU17.** regulatory compliance regarding telecommunications standards and spectrum allocation policies
- KU18.** emerging networking technologies and advancements in the field of 5G
- KU19.** network management practices and strategies for updates and optimizations
- KU20.** data analysis skills to interpret network performance metrics and make informed decisions

Generic Skills (GS)

User/individual on the job needs to know how to:



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- GS1.** interpret reports, readings and numerical data
- GS2.** fill up appropriate technical forms, and activity logs in the required format specified by the organization
- GS3.** comprehend formats and checklists for preventive maintenance and site hygiene
- GS4.** analyze situations and make appropriate decisions
- GS5.** prioritize and execute tasks in a high-pressure environment and handle high-pressure situations
- GS6.** communicate effectively with peers, supervisors and clients
- GS7.** utilize appropriate communication channels to escalate unresolved problems to relevant stakeholders

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Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Implement new networking technologies and protocols</i>	28	21	-	6
PC1. define the technical specifications for 5G network elements, including base stations (gNB), core network components, and user equipment	-	-	-	2
PC2. determine the frequency bands to be used for the IMT-2020 deployment.	3	4	-	-
PC3. allocate and specify the frequency bands to be used for 5G deployment, considering spectrum availability and compatibility	2	-	-	2
PC4. install the necessary infrastructure equipment, including base stations, Radio Access Network (RAN), and core network elements such as the serving and gateway	3	3	-	1
PC5. configure the RAN elements, including the base stations, eNodeB-EPC (Evolve Packet Core) and RNCs (Radio Network Controllers) or gNodeB.	3	4	-	-
PC6. perform network planning activities to design the coverage and capacity of the network	2	3	-	-
PC7. implement subscriber authentication and security mechanisms.	3	-	-	1
PC8. enable specific services and features, such as voice calls, data services, messaging, and multimedia services	5	1	-	-
PC9. perform testing and optimization activities to verify the network's performance and fine-tune the configuration parameters	5	2	-	-
PC10. analyse performance requirements for 5G networks, such as data rates, latency, and reliability, to ensure high-quality service delivery	2	4	-	-
<i>Network performance, scalability, and reliability</i>	22	19	-	4
PC11. evaluate the current capacity of your network infrastructure and identify the areas where scalability is required	3	2	-	-

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Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC12. analyze the traffic patterns and trends to understand the growth in network demand	6	2	-	-
PC13. develop interoperability standards to ensure seamless communication between different vendors' equipment and network elements	3	4	-	1
PC14. determine if the existing hardware and equipment can support the increased traffic demands	3	-	-	-
PC15. implement network monitoring and analytics tools to continuously monitor network performance	1	3	-	1
PC16. identify and troubleshoot network issues, such as latency, packet loss, and throughput	3	3	-	-
PC17. implement Quality of Service (QoS) mechanisms to prioritize critical services and applications, ensuring a consistent and reliable user experience	3	3	-	1
PC18. address regulatory aspects, including compliance with local and international telecommunications regulations and spectrum allocation policies	-	2	-	1
NOS Total	50	40	-	10

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National Occupational Standards (NOS) Parameters

NOS Code	TEL/N4205
NOS Name	Set Standards for 5G Network Architecture
Sector	Telecom
Sub-Sector	Passive Infrastructure
Occupation	Network (Passive) Installation
NSQF Level	5
Credits	5
Version	1.0
Last Reviewed Date	31/08/2023
Next Review Date	31/08/2026
NSQC Clearance Date	31/08/2023

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TEL/N4206: Verify and Prepare Hardware Equipment for 5G Installation

Description

This OS unit is about various activities carried out before installation of 5G nodes at site.

Scope

The scope covers the following :

- Pre-installation Analysis and Preparation
- Check Equipment Availability

Elements and Performance Criteria

Pre-installation Analysis and Preparation

To be competent, the user/individual on the job must be able to:

- PC1.** analyse 3GPP standards, budget, architectural, and other design documents as per client specifications
- PC2.** identify the basic parameters of Multiple Input, Multiple Output (MIMO) antenna (diversity gain, MIMO capacity, etc.) for implementation of 5G antenna
- PC3.** ensure that all passive equipment such as antenna (single, dual, triple band, MIMO), feeder, and jumper cable, and all the other necessary equipment are available at the site
- PC4.** ensure that all active equipment such as gNB, microwave link devices, etc. are available at the site
- PC5.** analyse solution life cycle management activities for successful deployment, such as evaluation and impact assessment of the solution and its components, and/or revisions if required
- PC6.** validate that the necessary licenses and permits for installing and operating the hardware equipment at the site have been obtained and are up-to-date
- PC7.** check the availability of weatherproofing and protective enclosures to safeguard the hardware equipment from environmental factors like rain, dust, and extreme temperatures
- PC8.** verify the compatibility and interoperability of the hardware equipment from different vendors to avoid potential integration issues during installation
- PC9.** ensure that any specialized equipment, tools, and accessories required for installation and configuration are available and ready for use
- PC10.** check the availability of required network cables, connectors, and other interconnection components to establish connectivity between different equipment units
- PC11.** confirm the availability of necessary grounding and lightning protection systems to protect the equipment from electrical surges and ensure safety
- PC12.** verify that the power supply and backup power systems (e.g., batteries, generators) are available and sufficient to support the 5G hardware equipment at the site
- PC13.** ensure that the required mounting structures and hardware, such as towers, poles, or rooftop installations, are in place to securely and appropriately mount the antennas and other equipment

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Check Equipment Availability

To be competent, the user/individual on the job must be able to:

- PC14.** conduct a thorough inventory check to confirm that all the hardware equipment items mentioned in the deployment plan are present and accounted for at the site
- PC15.** coordinate with logistics and procurement teams to ensure timely delivery of any missing or additional hardware equipment needed for the installation
- PC16.** inspect the condition and quality of the hardware equipment to ensure it is free from damage or defects before installation

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

- KU1.** Three (3) GPP standards and specifications relevant to 5G network deployment
- KU2.** principles and concepts of Multiple Input, Multiple Output (MIMO) technology
- KU3.** hardware components and specifications of passive equipment like antennas, feeders, and cables
- KU4.** functionality and technical requirements of active equipment such as gNodes and microwave link devices
- KU5.** procedures for validating and obtaining necessary licenses and permits for hardware installation
- KU6.** weatherproofing and protective measures to safeguard equipment from environmental elements
- KU7.** specific tools and equipment used for installation and configuration tasks
- KU8.** types of network cables, connectors, and interconnection standards used in 5G networks
- KU9.** grounding and lightning protection principles for equipment safety
- KU10.** power supply and backup system requirements to support 5G hardware
- KU11.** mounting structures and hardware specifications for different installation scenarios
- KU12.** inventory management practices and techniques for equipment tracking
- KU13.** inspection techniques to identify damages or defects in hardware equipment
- KU14.** health and safety regulations relevant to equipment installation and operation
- KU15.** troubleshooting methodologies to address potential integration issues
- KU16.** basics of network topology and architecture in 5G deployments
- KU17.** quality assurance and testing processes for hardware functionality and performance

Generic Skills (GS)

User/individual on the job needs to know how to:

- GS1.** communicate with team members accurately
- GS2.** analyse and interpret the messages and prompts timely and correctly
- GS3.** communicate with external stakeholders in their preferred language (English, Hindi or regional)

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- GS4.** provide advice and guidance to peers and juniors
- GS5.** seek experts help timely, if needed at any stage
- GS6.** prioritize tasks in high-pressure environment
- GS7.** interpret reports and numerical data
- GS8.** perform multiple tasks/activities at the same time
- GS9.** read standards documents such as provisioning guide, reports, requirement guides, user manuals
- GS10.** adapt new technologies

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Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Pre-installation Analysis and Preparation</i>	37	35	-	8
PC1. analyse 3GPP standards, budget, architectural, and other design documents as per client specifications	-	4	-	1
PC2. identify the basic parameters of Multiple Input, Multiple Output (MIMO) antenna (diversity gain, MIMO capacity, etc.) for implementation of 5G antenna	5	4	-	1
PC3. ensure that all passive equipment such as antenna (single, dual, triple band, MIMO), feeder, and jumper cable, and all the other necessary equipment are available at the site	1	4	-	-
PC4. ensure that all active equipment such as gNB, microwave link devices, etc. are available at the site	1	2	-	1
PC5. analyse solution life cycle management activities for successful deployment, such as evaluation and impact assessment of the solution and its components, and/or revisions if required	4	3	-	2
PC6. validate that the necessary licenses and permits for installing and operating the hardware equipment at the site have been obtained and are up-to-date	4	4	-	-
PC7. check the availability of weatherproofing and protective enclosures to safeguard the hardware equipment from environmental factors like rain, dust, and extreme temperatures	2	2	-	1
PC8. verify the compatibility and interoperability of the hardware equipment from different vendors to avoid potential integration issues during installation	3	2	-	-
PC9. ensure that any specialized equipment, tools, and accessories required for installation and configuration are available and ready for use	2	3	-	-

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Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC10. check the availability of required network cables, connectors, and other interconnection components to establish connectivity between different equipment units	4	2	-	1
PC11. confirm the availability of necessary grounding and lightning protection systems to protect the equipment from electrical surges and ensure safety	2	1	-	-
PC12. verify that the power supply and backup power systems (e.g., batteries, generators) are available and sufficient to support the 5G hardware equipment at the site	5	2	-	-
PC13. ensure that the required mounting structures and hardware, such as towers, poles, or rooftop installations, are in place to securely and appropriately mount the antennas and other equipment	4	2	-	1
<i>Check Equipment Availability</i>	13	5	-	2
PC14. conduct a thorough inventory check to confirm that all the hardware equipment items mentioned in the deployment plan are present and accounted for at the site	4	3	-	1
PC15. coordinate with logistics and procurement teams to ensure timely delivery of any missing or additional hardware equipment needed for the installation	5	-	-	1
PC16. inspect the condition and quality of the hardware equipment to ensure it is free from damage or defects before installation	4	2	-	-
NOS Total	50	40	-	10

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National Occupational Standards (NOS) Parameters

NOS Code	TEL/N4206
NOS Name	Verify and Prepare Hardware Equipment for 5G Installation
Sector	Telecom
Sub-Sector	Passive Infrastructure
Occupation	Network (Passive) Installation
NSQF Level	5
Credits	3
Version	1.0
Last Reviewed Date	31/08/2023
Next Review Date	31/08/2026
NSQC Clearance Date	31/08/2023

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TEL/N4207: Design Spectrum and 5G Network Architecture

Description

This OS unit is about identifying and investigating the Importance of Spectrum and Network Architecture.

Scope

The scope covers the following :

- Spectrum utilization and 5G network design
- Integration of network types for seamless connectivity

Elements and Performance Criteria

Spectrum Utilization and 5G Network Design

To be competent, the user/individual on the job must be able to:

- PC1.** analyze spectrum availability and regulations to determine suitable frequency bands for 5g deployment
- PC2.** plan and allocate frequency resources to different services and applications based on their requirements and priority
- PC3.** design 5G network architecture to support dynamic spectrum sharing between different operators and technologies
- PC4.** optimize radio access network (RAN) design to ensure efficient utilization of available spectrum resources
- PC5.** evaluate the impact of interference and propagation characteristics on spectrum allocation and network coverage
- PC6.** implement advanced spectrum management techniques, such as cognitive radio, to enhance spectrum efficiency
- PC7.** insert frequency bands for 5G
- PC8.** deploy the rectified traffic for 5G network
- PC9.** identify suitable sites for installing 5G network equipment, such as base stations or small cells
- PC10.** Install and configure the necessary network equipment, including base stations, antennas, and routers, based on the network design and specifications
- PC11.** perform extensive testing of the network to ensure proper functionality, coverage, and capacity

Integration of Network Types for Seamless Connectivity

To be competent, the user/individual on the job must be able to:

- PC12.** familiarize with the capabilities, limitations, and integration requirements of each network type
- PC13.** identify the different network types that need to be integrated and combined, such as cellular, Wi-Fi, satellite, or other specialized networks
- PC14.** evaluate the interoperability of the network types and their compatibility with each other

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- PC15.** utilize integration techniques to ensure interoperability and smooth handover between Wi-Fi, and 4G/5G networks
- PC16.** design and optimize network architectures that efficiently combine and utilize different network types to provide seamless connectivity and coverage
- PC17.** implement traffic management techniques, such as Quality of Service (QoS) mechanisms, traffic shaping, and load balancing, to prioritize and allocate resources efficiently based on traffic requirements
- PC18.** address challenges related to network handoff, authentication, and roaming across diverse network architectures
- PC19.** use FQDN in the 5G core network to enable efficient and scalable communication between network functions, 5G numbering, addressing services, and devices

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

- KU1.** fundamentals of wireless communication, including radio frequency (RF) propagation, modulation techniques, and spectral efficiency
- KU2.** Three (3) GPP standards and specifications for 5G networks, including frequency bands and channel access methods
- KU3.** regulatory guidelines and spectrum allocation policies governing the use of wireless frequency bands for telecommunications
- KU4.** principles of radio wave propagation and its impact on coverage, interference, and capacity planning in wireless networks
- KU5.** techniques for spectrum analysis and measurement tools to assess spectrum availability and interference levels
- KU6.** methods for frequency planning and resource allocation to meet the diverse requirements of 5G services and applications
- KU7.** network architecture and design principles for dynamic spectrum sharing and efficient coexistence of different operators and technologies
- KU8.** advanced spectrum management techniques, such as cognitive radio, spectrum sensing, and dynamic spectrum access
- KU9.** spectrum licensing and frequency coordination processes to comply with regulatory requirements and avoid interference
- KU10.** network slicing concepts and how to tailor virtual network instances for different services and user groups
- KU11.** principles of network integration and interworking between different types of networks, including cellular, Wi-Fi, and satellite
- KU12.** handover mechanisms and seamless mobility management across heterogeneous network environments
- KU13.** quality of service (QoS) mechanisms and traffic engineering techniques for efficient resource allocation and prioritization
- KU14.** the role of Fully Qualified Domain Name (FQDN) in the 5G core network
- KU15.** security considerations and authentication mechanisms
- KU16.** network performance testing and optimization methodologies

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- KU17.** Five (5)G network equipment and hardware components, including base stations, antennas, routers, and their configurations
- KU18.** network design and architectural concepts
- KU19.** cross-functional collaboration with various stakeholders, such as network operators, regulators, and equipment vendors, to facilitate seamless integration of network types and spectrum utilization
- KU20.** evolving trends and developments in wireless communication technologies and spectrum management practices

Generic Skills (GS)

User/individual on the job needs to know how to:

- GS1.** stay up-to-date with new technology
- GS2.** read and understand reports, readings and numerical data
- GS3.** fill up appropriate technical forms, and activity logs in the required format specified by the organization
- GS4.** maintain proper records as per organization standards
- GS5.** analyze situations and evaluate the possible solution(s) to the problem
- GS6.** use and maintain the available resources efficiently and effectively
- GS7.** take initiatives and progressively assume increased responsibilities
- GS8.** work under a high-pressure situation
- GS9.** adhere to the timelines
- GS10.** adopt an organized and systematic approach to arrive at an optimum solution
- GS11.** communicate effectively with peers, supervisors and clients, and utilize appropriate communication channels to escalate unresolved problems

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Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Spectrum Utilization and 5G Network Design</i>	23	21	-	5
PC1. analyze spectrum availability and regulations to determine suitable frequency bands for 5g deployment	2	2	-	-
PC2. plan and allocate frequency resources to different services and applications based on their requirements and priority	4	-	-	2
PC3. design 5G network architecture to support dynamic spectrum sharing between different operators and technologies	-	4	-	1
PC4. optimize radio access network (RAN) design to ensure efficient utilization of available spectrum resources	3	2	-	-
PC5. evaluate the impact of interference and propagation characteristics on spectrum allocation and network coverage	5	-	-	-
PC6. implement advanced spectrum management techniques, such as cognitive radio, to enhance spectrum efficiency	2	2	-	-
PC7. insert frequency bands for 5G	-	2	-	-
PC8. deploy the rectified traffic for 5G network	-	2	-	1
PC9. identify suitable sites for installing 5G network equipment, such as base stations or small cells	3	-	-	1
PC10. Install and configure the necessary network equipment, including base stations, antennas, and routers, based on the network design and specifications	2	4	-	-
PC11. perform extensive testing of the network to ensure proper functionality, coverage, and capacity	2	3	-	-
<i>Integration of Network Types for Seamless Connectivity</i>	27	19	-	5

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Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC12. familiarize with the capabilities, limitations, and integration requirements of each network type	4	-	-	-
PC13. identify the different network types that need to be integrated and combined, such as cellular, Wi-Fi, satellite, or other specialized networks	2	2	-	1
PC14. evaluate the interoperability of the network types and their compatibility with each other	4	3	-	-
PC15. utilize integration techniques to ensure interoperability and smooth handover between Wi-Fi, and 4G/5G networks	3	3	-	1
PC16. design and optimize network architectures that efficiently combine and utilize different network types to provide seamless connectivity and coverage	3	4	-	1
PC17. implement traffic management techniques, such as Quality of Service (QoS) mechanisms, traffic shaping, and load balancing, to prioritize and allocate resources efficiently based on traffic requirements	5	4	-	1
PC18. address challenges related to network handoff, authentication, and roaming across diverse network architectures	3	2	-	-
PC19. use FQDN in the 5G core network to enable efficient and scalable communication between network functions, 5G numbering, addressing services, and devices	3	1	-	1
NOS Total	50	40	-	10

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National Occupational Standards (NOS) Parameters

NOS Code	TEL/N4207
NOS Name	Design Spectrum and 5G Network Architecture
Sector	Telecom
Sub-Sector	Passive Infrastructure
Occupation	Network (Passive) Installation
NSQF Level	5
Credits	4
Version	1.0
Last Reviewed Date	31/08/2023
Next Review Date	31/08/2026
NSQF Clearance Date	31/08/2023

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TEL/N4208: Implement the 5G New Radio (NR) and Radio Access

Description

This OS unit is about maintaining the database and various 5G NR and Radio Access.

Scope

The scope covers the following :

- Regularly update database
- 5G radio access detection

Elements and Performance Criteria

Regularly update database

To be competent, the user/individual on the job must be able to:

- PC1.** implement robust network access control mechanisms to prevent unauthorized or irregular data resources from accessing the 5G system
- PC2.** deploy firewalls and intrusion detection/prevention systems (IDS/IPS) to monitor and filter incoming and outgoing traffic
- PC3.** utilize content filtering mechanisms to block access to specific websites, domains, or IP addresses associated with foreign or irregular data resources
- PC4.** employ traffic analysis tools and anomaly detection systems to monitor network traffic patterns and identify irregular or suspicious behavior
- PC5.** implement deep packet inspection (DPI) techniques to analyze packet contents and identify foreign or irregular data resources based on specific protocols, signatures, or patterns
- PC6.** ensure that all network components, including routers, switches, firewalls, and security systems, are regularly updated with the latest security patches and firmware updates
- PC7.** continuously monitor network traffic, security logs, and system events to detect and respond to any attempts to access or distribute foreign or irregular data resources
- PC8.** monitor 5G NR Physical Channels and Signals
- PC9.** acquire specialized monitoring equipment capable of analyzing 5G NR physical channels and signals
- PC10.** use the monitoring equipment to capture the 5G NR physical channels and signals
- PC11.** monitor the different 5G NR physical channels, such as the downlink and uplink channels, control channels, synchronization channels, and reference signals
- PC12.** conduct real-time monitoring of the 5G NR physical channels and signals to capture dynamic changes and fluctuations
- PC13.** analyze the resource allocation and scheduling mechanisms used for downlink transmission
- PC14.** identify and configure BWP Configuration of 5G networking
- PC15.** work with Physical Layer Procedures of 5G networks
- PC16.** layer the data signals to Initial Access and Cell Search

5G radio access detection

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To be competent, the user/individual on the job must be able to:

- PC17.** operate the PSS and SSS Detection
- PC18.** capture the received signals using a suitable receiver or monitoring equipment capable of capturing the 5G signals
- PC19.** perform a frequency analysis on the captured signals to identify the frequency range where the PSS and SSS signals are expected to be present
- PC20.** synchronize the received signals with the expected timing and frame structure of the 5G system
- PC21.** implement error handling mechanisms to account for cases where the PSS or SSS signals are weak, corrupted, or not detected correctly
- PC22.** continuously validate the accuracy and reliability of the PSS and SSS detection process by monitoring the detected signals and verifying the correctness of the cell identification
- PC23.** channel Estimation and Equalization with nodes for 5G connectivity
- PC24.** demodulate and Decode the backend coding of 5G networks
- PC25.** install and rectify Analog Beamforming
- PC26.** station and reconstruct Digital Beamforming
- PC27.** inspect the Hybrid Beamforming
- PC28.** fix beamforming configuration

Industry-specific Use Cases

To be competent, the user/individual on the job must be able to:

- PC29.** implement 5G in industrial 4.0 such as manufacturing, production, transportation and warehousing
- PC30.** implement 5G in various sectors such as agriculture, entertainment, smart education and public safety

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

- KU1.** operations of Spectrum for 5G NR
- KU2.** interface of Scalable OFDM
- KU3.** different 5G NR Numerology
- KU4.** frame Structure of 5G networking
- KU5.** TDD/FDD Duplexing schemes of 5G networking
- KU6.** SS Block of 5G network
- KU7.** Five (5G) NR Synchronization Procedure
- KU8.** the key aspects of scalable OFDM
- KU9.** aspects of 5G NR numerology
- KU10.** types of 5G NR Frame Structure
- KU11.** time Domain Structure to improve the 5G network
- KU12.** frequency Domain Structure
- KU13.** advanced Features of new 5G domain

Qualification Pack

- KU14.** the requirements of Time Division Duplexing (TDD) in 5G networks
- KU15.** the use of Frequency Division Duplexing (FDD) in 5G networks
- KU16.** the measures of Hybrid TDD/FDD Duplexing in 5G networks
- KU17.** different BWP Types
- KU18.** benefits of BWPs
- KU19.** types of MIMO
- KU20.** benefits of MIMO in 5G NR
- KU21.** fix Beamforming of in 5G leakage
- KU22.** the role of 5G in transportation, energy and manufacturing industry
- KU23.** the position of 5G in entertainment band public safety sectors

Generic Skills (GS)

User/individual on the job needs to know how to:

- GS1.** interpret reports, readings and numerical data
- GS2.** fill up appropriate technical forms, and activity logs in the required format of the organization
- GS3.** Create documentation required on the job regarding the details of the alarm, server maintenance, up time and down time, etc
- GS4.** analyze information and evaluate results to choose the best solution and solve the issue
- GS5.** evaluate the possible solutions to the problem
- GS6.** decide the most suitable course of action for completing the task within the timeline
- GS7.** recognize a workplace problem or a potential problem and take action
- GS8.** prioritize and execute tasks in a high-pressure environment and handle high-pressure situations
- GS9.** analyze, evaluate and apply the information gathered from observation, experience, reasoning, or communication to act efficiently
- GS10.** refer problems outside your area of responsibility to the appropriate person
- GS11.** communicate with colleagues and supervisors to handle verbal enquiries, such as clarifying instructions and responding to requests for information

Qualification Pack

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Regularly update database</i>	19	25	-	4
PC1. implement robust network access control mechanisms to prevent unauthorized or irregular data resources from accessing the 5G system	1	2	-	-
PC2. deploy firewalls and intrusion detection/prevention systems (IDS/IPS) to monitor and filter incoming and outgoing traffic	2	3	-	1
PC3. utilize content filtering mechanisms to block access to specific websites, domains, or IP addresses associated with foreign or irregular data resources	1	3	-	1
PC4. employ traffic analysis tools and anomaly detection systems to monitor network traffic patterns and identify irregular or suspicious behavior	2	2	-	-
PC5. implement deep packet inspection (DPI) techniques to analyze packet contents and identify foreign or irregular data resources based on specific protocols, signatures, or patterns	1	2	-	-
PC6. ensure that all network components, including routers, switches, firewalls, and security systems, are regularly updated with the latest security patches and firmware updates	1	-	-	1
PC7. continuously monitor network traffic, security logs, and system events to detect and respond to any attempts to access or distribute foreign or irregular data resources	1	1	-	-
PC8. monitor 5G NR Physical Channels and Signals	2	1	-	-
PC9. acquire specialized monitoring equipment capable of analyzing 5G NR physical channels and signals	2	1	-	-
PC10. use the monitoring equipment to capture the 5G NR physical channels and signals	-	3	-	-

Qualification Pack

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. monitor the different 5G NR physical channels, such as the downlink and uplink channels, control channels, synchronization channels, and reference signals	1	1	-	-
PC12. conduct real-time monitoring of the 5G NR physical channels and signals to capture dynamic changes and fluctuations	2	2	-	-
PC13. analyze the resource allocation and scheduling mechanisms used for downlink transmission	1	2	-	-
PC14. identify and configure BWP Configuration of 5G networking	-	1	-	-
PC15. work with Physical Layer Procedures of 5G networks	1	-	-	1
PC16. layer the data signals to Initial Access and Cell Search	1	1	-	-
<i>5G radio access detection</i>	15	25	-	4
PC17. operate the PSS and SSS Detection	2	2	-	-
PC18. capture the received signals using a suitable receiver or monitoring equipment capable of capturing the 5G signals	1	3	-	1
PC19. perform a frequency analysis on the captured signals to identify the frequency range where the PSS and SSS signals are expected to be present	1	3	-	-
PC20. synchronize the received signals with the expected timing and frame structure of the 5G system	2	2	-	1
PC21. implement error handling mechanisms to account for cases where the PSS or SSS signals are weak, corrupted, or not detected correctly	2	2	-	-
PC22. continuously validate the accuracy and reliability of the PSS and SSS detection process by monitoring the detected signals and verifying the correctness of the cell identification	2	2	-	1

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Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC23. channel Estimation and Equalization with nodes for 5G connectivity	1	1	-	1
PC24. demodulate and Decode the backend coding of 5G networks	1	2	-	-
PC25. install and rectify Analog Beamforming	1	2	-	-
PC26. station and reconstruct Digital Beamforming	-	2	-	-
PC27. inspect the Hybrid Beamforming	1	2	-	-
PC28. fix beamforming configuration	1	2	-	-
<i>Industry-specific Use Cases</i>	6	-	-	2
PC29. implement 5G in industrial 4.0 such as manufacturing, production, transportation and warehousing	3	-	-	1
PC30. implement 5G in various sectors such as agriculture, entertainment, smart education and public safety	3	-	-	1
NOS Total	40	50	-	10

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	TEL/N4208
NOS Name	Implement the 5G New Radio (NR) and Radio Access
Sector	Telecom
Sub-Sector	Passive Infrastructure
Occupation	Network (Passive) Installation
NSQF Level	5
Credits	4
Version	1.0
Last Reviewed Date	31/08/2023
Next Review Date	31/08/2026
NSQC Clearance Date	31/08/2023

Qualification Pack

DGT/VSQ/N0102: Employability Skills (60 Hours)

Description

This unit is about employability skills, Constitutional values, becoming a professional in the 21st Century, digital, financial, and legal literacy, diversity and Inclusion, English and communication skills, customer service, entrepreneurship, and apprenticeship, getting ready for jobs and career development.

Scope

The scope covers the following :

- Introduction to Employability Skills
- Constitutional values - Citizenship
- Becoming a Professional in the 21st Century
- Basic English Skills
- Career Development & Goal Setting
- Communication Skills
- Diversity & Inclusion
- Financial and Legal Literacy
- Essential Digital Skills
- Entrepreneurship
- Customer Service
- Getting ready for Apprenticeship & Jobs

Elements and Performance Criteria

Introduction to Employability Skills

To be competent, the user/individual on the job must be able to:

- PC1.** identify employability skills required for jobs in various industries
- PC2.** identify and explore learning and employability portals

Constitutional values - Citizenship

To be competent, the user/individual on the job must be able to:

- PC3.** recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society etc. and personal values and ethics such as honesty, integrity, caring and respecting others, etc.
- PC4.** follow environmentally sustainable practices

Becoming a Professional in the 21st Century

To be competent, the user/individual on the job must be able to:

- PC5.** recognize the significance of 21st Century Skills for employment
- PC6.** practice the 21st Century Skills such as Self-Awareness, Behaviour Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn for continuous learning etc. in personal and professional life

Basic English Skills

To be competent, the user/individual on the job must be able to:

Qualification Pack

- PC7.** use basic English for everyday conversation in different contexts, in person and over the telephone
- PC8.** read and understand routine information, notes, instructions, mails, letters etc. written in English
- PC9.** write short messages, notes, letters, e-mails etc. in English

Career Development & Goal Setting

To be competent, the user/individual on the job must be able to:

- PC10.** understand the difference between job and career
- PC11.** prepare a career development plan with short- and long-term goals, based on aptitude

Communication Skills

To be competent, the user/individual on the job must be able to:

- PC12.** follow verbal and non-verbal communication etiquette and active listening techniques in various settings
- PC13.** work collaboratively with others in a team

Diversity & Inclusion

To be competent, the user/individual on the job must be able to:

- PC14.** communicate and behave appropriately with all genders and PwD
- PC15.** escalate any issues related to sexual harassment at workplace according to POSH Act

Financial and Legal Literacy

To be competent, the user/individual on the job must be able to:

- PC16.** select financial institutions, products and services as per requirement
- PC17.** carry out offline and online financial transactions, safely and securely
- PC18.** identify common components of salary and compute income, expenses, taxes, investments etc
- PC19.** identify relevant rights and laws and use legal aids to fight against legal exploitation

Essential Digital Skills

To be competent, the user/individual on the job must be able to:

- PC20.** operate digital devices and carry out basic internet operations securely and safely
- PC21.** use e- mail and social media platforms and virtual collaboration tools to work effectively
- PC22.** use basic features of word processor, spreadsheets, and presentations

Entrepreneurship

To be competent, the user/individual on the job must be able to:

- PC23.** identify different types of Entrepreneurship and Enterprises and assess opportunities for potential business through research
- PC24.** develop a business plan and a work model, considering the 4Ps of Marketing Product, Price, Place and Promotion
- PC25.** identify sources of funding, anticipate, and mitigate any financial/ legal hurdles for the potential business opportunity

Customer Service

To be competent, the user/individual on the job must be able to:

- PC26.** identify different types of customers
- PC27.** identify and respond to customer requests and needs in a professional manner.

Qualification Pack

PC28. follow appropriate hygiene and grooming standards

Getting ready for apprenticeship & Jobs

To be competent, the user/individual on the job must be able to:

PC29. create a professional Curriculum vitae (Résumé)

PC30. search for suitable jobs using reliable offline and online sources such as Employment exchange, recruitment agencies, newspapers etc. and job portals, respectively

PC31. apply to identified job openings using offline /online methods as per requirement

PC32. answer questions politely, with clarity and confidence, during recruitment and selection

PC33. identify apprenticeship opportunities and register for it as per guidelines and requirements

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. need for employability skills and different learning and employability related portals

KU2. various constitutional and personal values

KU3. different environmentally sustainable practices and their importance

KU4. Twenty first (21st) century skills and their importance

KU5. how to use English language for effective verbal (face to face and telephonic) and written communication in formal and informal set up

KU6. importance of career development and setting long- and short-term goals

KU7. about effective communication

KU8. POSH Act

KU9. Gender sensitivity and inclusivity

KU10. different types of financial institutes, products, and services

KU11. how to compute income and expenditure

KU12. importance of maintaining safety and security in offline and online financial transactions

KU13. different legal rights and laws

KU14. different types of digital devices and the procedure to operate them safely and securely

KU15. how to create and operate an e- mail account and use applications such as word processors, spreadsheets etc.

KU16. how to identify business opportunities

KU17. types and needs of customers

KU18. how to apply for a job and prepare for an interview

KU19. apprenticeship scheme and the process of registering on apprenticeship portal

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. read and write different types of documents/instructions/correspondence

GS2. communicate effectively using appropriate language in formal and informal settings



Qualification Pack

- GS3.** behave politely and appropriately with all
- GS4.** how to work in a virtual mode
- GS5.** perform calculations efficiently
- GS6.** solve problems effectively
- GS7.** pay attention to details
- GS8.** manage time efficiently
- GS9.** maintain hygiene and sanitization to avoid infection

Qualification Pack

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Introduction to Employability Skills</i>	1	1	-	-
PC1. identify employability skills required for jobs in various industries	-	-	-	-
PC2. identify and explore learning and employability portals	-	-	-	-
<i>Constitutional values - Citizenship</i>	1	1	-	-
PC3. recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society etc. and personal values and ethics such as honesty, integrity, caring and respecting others, etc.	-	-	-	-
PC4. follow environmentally sustainable practices	-	-	-	-
<i>Becoming a Professional in the 21st Century</i>	2	4	-	-
PC5. recognize the significance of 21st Century Skills for employment	-	-	-	-
PC6. practice the 21st Century Skills such as Self-Awareness, Behaviour Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn for continuous learning etc. in personal and professional life	-	-	-	-
<i>Basic English Skills</i>	2	3	-	-
PC7. use basic English for everyday conversation in different contexts, in person and over the telephone	-	-	-	-
PC8. read and understand routine information, notes, instructions, mails, letters etc. written in English	-	-	-	-
PC9. write short messages, notes, letters, e-mails etc. in English	-	-	-	-
<i>Career Development & Goal Setting</i>	1	2	-	-

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Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC10. understand the difference between job and career	-	-	-	-
PC11. prepare a career development plan with short- and long-term goals, based on aptitude	-	-	-	-
<i>Communication Skills</i>	2	2	-	-
PC12. follow verbal and non-verbal communication etiquette and active listening techniques in various settings	-	-	-	-
PC13. work collaboratively with others in a team	-	-	-	-
<i>Diversity & Inclusion</i>	1	2	-	-
PC14. communicate and behave appropriately with all genders and PwD	-	-	-	-
PC15. escalate any issues related to sexual harassment at workplace according to POSH Act	-	-	-	-
<i>Financial and Legal Literacy</i>	2	3	-	-
PC16. select financial institutions, products and services as per requirement	-	-	-	-
PC17. carry out offline and online financial transactions, safely and securely	-	-	-	-
PC18. identify common components of salary and compute income, expenses, taxes, investments etc	-	-	-	-
PC19. identify relevant rights and laws and use legal aids to fight against legal exploitation	-	-	-	-
<i>Essential Digital Skills</i>	3	4	-	-
PC20. operate digital devices and carry out basic internet operations securely and safely	-	-	-	-
PC21. use e- mail and social media platforms and virtual collaboration tools to work effectively	-	-	-	-
PC22. use basic features of word processor, spreadsheets, and presentations	-	-	-	-

Qualification Pack

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Entrepreneurship</i>	2	3	-	-
PC23. identify different types of Entrepreneurship and Enterprises and assess opportunities for potential business through research	-	-	-	-
PC24. develop a business plan and a work model, considering the 4Ps of Marketing Product, Price, Place and Promotion	-	-	-	-
PC25. identify sources of funding, anticipate, and mitigate any financial/ legal hurdles for the potential business opportunity	-	-	-	-
<i>Customer Service</i>	1	2	-	-
PC26. identify different types of customers	-	-	-	-
PC27. identify and respond to customer requests and needs in a professional manner.	-	-	-	-
PC28. follow appropriate hygiene and grooming standards	-	-	-	-
<i>Getting ready for apprenticeship & Jobs</i>	2	3	-	-
PC29. create a professional Curriculum vitae (Résumé)	-	-	-	-
PC30. search for suitable jobs using reliable offline and online sources such as Employment exchange, recruitment agencies, newspapers etc. and job portals, respectively	-	-	-	-
PC31. apply to identified job openings using offline /online methods as per requirement	-	-	-	-
PC32. answer questions politely, with clarity and confidence, during recruitment and selection	-	-	-	-
PC33. identify apprenticeship opportunities and register for it as per guidelines and requirements	-	-	-	-
NOS Total	20	30	-	-

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	DGT/VSQ/N0102
NOS Name	Employability Skills (60 Hours)
Sector	Cross Sectoral
Sub-Sector	Professional Skills
Occupation	Employability
NSQF Level	4
Credits	2
Version	1.0
Last Reviewed Date	31/08/2023
Next Review Date	31/08/2026
NSQC Clearance Date	31/08/2023

Assessment Guidelines and Assessment Weightage

Assessment Guidelines

1. Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council.
2. Element/Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each Element/PC.
3. The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
4. Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/option NOS/set of NOS.
5. Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training center (as per assessment criteria below).
6. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/ training center based on these criteria.

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7. To pass the Qualification Pack assessment, every trainee should score the Recommended Pass % aggregate for the QP.

8. In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack.

Minimum Aggregate Passing % at QP Level : 70

(Please note: Every Trainee should score a minimum aggregate passing percentage as specified above, to successfully clear the Qualification Pack assessment.)

Assessment Weightage

Compulsory NOS

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
TEL/N4205.Set Standards for 5G Network Architecture	50	40	-	10	100	20
TEL/N4206.Verify and Prepare Hardware Equipment for 5G Installation	50	40	-	10	100	20
TEL/N4207.Design Spectrum and 5G Network Architecture	50	40	-	10	100	20
TEL/N4208.Implement the 5G New Radio (NR) and Radio Access	40	50	-	10	100	20
DGT/VSQ/N0102.Employability Skills (60 Hours)	20	30	-	-	50	20
Total	210	200	-	40	450	100

Qualification Pack

Acronyms

NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training

Qualification Pack

Glossary

Sector	Sector is a conglomeration of different business operations having similar business and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests.
Sub-sector	Sub-sector is derived from a further breakdown based on the characteristics and interests of its components.
Occupation	Occupation is a set of job roles, which perform similar/ related set of functions in an industry.
Job role	Job role defines a unique set of functions that together form a unique employment opportunity in an organisation.
Occupational Standards (OS)	OS specify the standards of performance an individual must achieve when carrying out a function in the workplace, together with the Knowledge and Understanding (KU) they need to meet that standard consistently. Occupational Standards are applicable both in the Indian and global contexts.
Performance Criteria (PC)	Performance Criteria (PC) are statements that together specify the standard of performance required when carrying out a task.
National Occupational Standards (NOS)	NOS are occupational standards which apply uniquely in the Indian context.
Qualifications Pack (QP)	QP comprises the set of OS, together with the educational, training and other criteria required to perform a job role. A QP is assigned a unique qualifications pack code.
Unit Code	Unit code is a unique identifier for an Occupational Standard, which is denoted by an 'N'
Unit Title	Unit title gives a clear overall statement about what the incumbent should be able to do.
Description	Description gives a short summary of the unit content. This would be helpful to anyone searching on a database to verify that this is the appropriate OS they are looking for.
Scope	Scope is a set of statements specifying the range of variables that an individual may have to deal with in carrying out the function which have a critical impact on quality of performance required.

Qualification Pack

Knowledge and Understanding (KU)	Knowledge and Understanding (KU) are statements which together specify the technical, generic, professional and organisational specific knowledge that an individual needs in order to perform to the required standard.
Organisational Context	Organisational context includes the way the organisation is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility.
Technical Knowledge	Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
Core Skills/ Generic Skills (GS)	Core skills or Generic Skills (GS) are a group of skills that are the key to learning and working in today's world. These skills are typically needed in any work environment in today's world. These skills are typically needed in any work environment. In the context of the OS, these include communication related skills that are applicable to most job roles.
Electives	Electives are NOS/set of NOS that are identified by the sector as contributive to specialization in a job role. There may be multiple electives within a QP for each specialized job role. Trainees must select at least one elective for the successful completion of a QP with Electives.
Options	Options are NOS/set of NOS that are identified by the sector as additional skills. There may be multiple options within a QP. It is not mandatory to select any of the options to complete a QP with Options.