



**NATIONAL COMPETENCY STANDARDS
FOR
COMPUTER HARDWARE & NETWORK
TECHNICIAN
(NC2 & NC3)**

**Department of Occupational Standards
Ministry of Labour and Human Resources
Thimphu, Bhutan.
(November, 2019)**

First Publication 2012

First Revision 2015

Second Revision 2019

© Department of Occupational Standards (DOS), MoLHR

FOREWORD

The Department of Occupational Standards of the Ministry of Labour and Human Resources is pleased to present the revised National Competency Standards (NCSs) for Computer Hardware & Network Technician. The standards represent the fruits of hard work and invaluable experiences gained by the department since its establishment in the latter half of 2003. The main aim of developing NCS is to set up a well-defined nationally recognized Vocational Qualification System that will help set a benchmark for the Technical Vocational Education and Training (TVET) System in our country aligned to international best practices.

NCS is one of the base pillars in the Bhutan Vocational Qualification Framework (BVQF) and is the first step in its implementation. The NCS are developed and revised to ensure that employees or vocational graduates possess and acquire the desired competencies required by industries and employers. In order to ensure this close match in supply and demand of competencies, NCS have been developed and revised in close consultation and partnership with industry experts and validated by the Technical Advisory Committees of the concerned economic sectors.

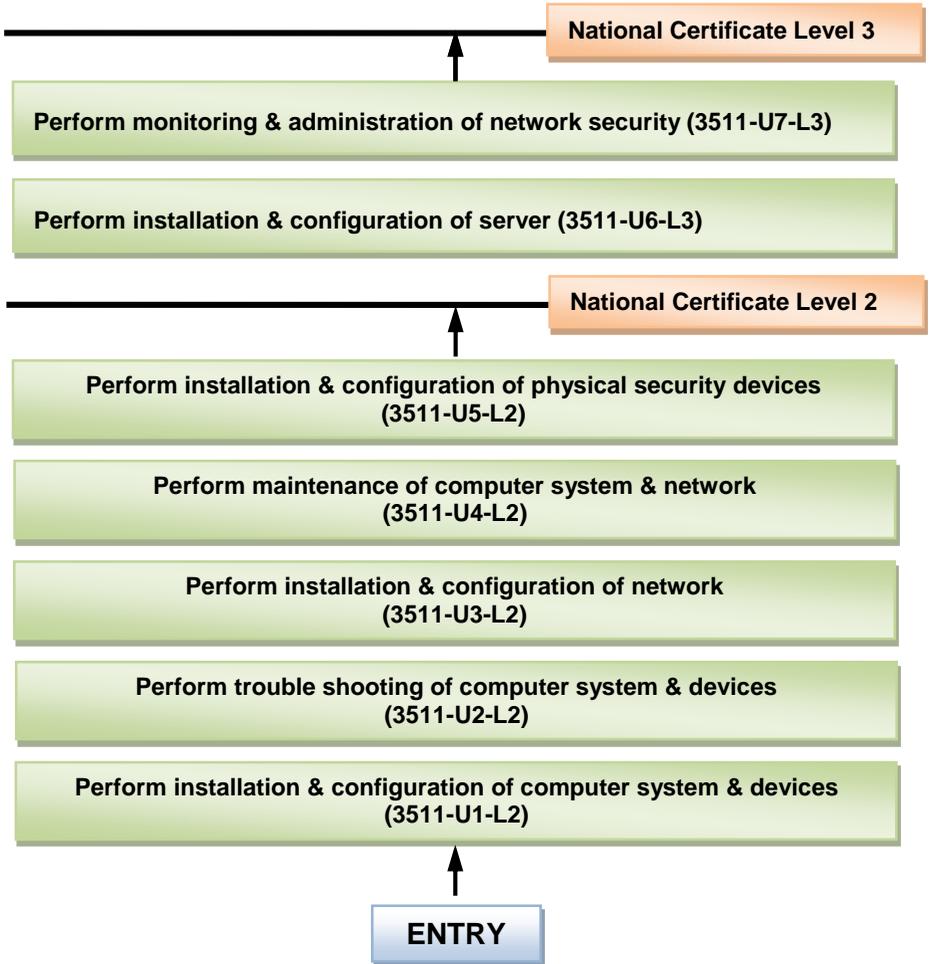
A vocational education and training system based on NCS shall ensure that delivered training is of a high quality and relevant to the needs of the labour market. As a result, future TVET graduates will be better equipped to meet the need and expectations of industries and employers. This positive impact on the employability of TVET graduates will enhance the reputation of vocational education and training and make it attractive to school leavers.

I gratefully acknowledge collaboration and the valuable contributions made by experts from industries during the consultation and validation processes of the standards. I look forward for continued engagement and participation of the industry and employers in the development of a quality assured demand driven TVET system and to build competent and productive national workforce that will contribute to the continued socio-economic progress of our country.

Director
Department of Occupational Standards
Ministry of Labour and Human Resources

PACKAGING OF QUALIFICATIONS

The National Competency standards for Computer Hardware & Network Technician comprises of seven unit of competencies. The packaging of qualification are as shown below:



NATIONAL COMPETENCY STANDARDS FOR COMPUTER HARDWARE & NETWORK TECHNICIAN

Validation date : October 30, 2019

Endorsement date : November 10, 2019

Date of Review : November 10, 2022(Max. 3 years).

Subject experts/validators involved in the development and validation of NCS for Computer Hardware & Network Technician.

1. Sangay Dema. Phuntsholing Thromde
2. Rinchen Choden. Phuntsholing Thromde
3. Karma Choizang. Phuntsholing
4. Rinchen Dorji. Phuntsholing
5. Tashi Tobgyel. Supernet Infocom, Phuntsholing
6. Karma Loday, Chief Programme Officer, Standards and Qualification Division, Department of Occupational Standards, MoLHR, Thimphu

Facilitators:

1. Chogay Lhendup, Program Officer. Department of Occupational Standards (DOS), MoLHR, Thimphu
2. Wangchuk Zangmo, Program Officer. Department of Occupational Standards (DOS), MoLHR, Thimphu

OVERVIEW OF COMPETENCY STANDARDS FOR COMPUTER HARDWARE & NETWORK TECHNICIAN (NC2)

UNIT TITLE	ELEMENTS OF COMPETENCE
Perform installation and configuration of computer system and devices	<ol style="list-style-type: none"> 1. Install systems and devices 2. Configure system and devices 3. Conduct test
Perform troubleshooting of computer system and devices	<ol style="list-style-type: none"> 1. Diagnose faults 2. Rectify faults
Perform installation and configuration of network	<ol style="list-style-type: none"> 1. Install network 2. Configure network 3. Conduct test
Perform maintenance of computer systems and network	<ol style="list-style-type: none"> 1. Prepare for maintenance work 2. Carry out maintenance.
Perform installation and configuration of physical security devices	<ol style="list-style-type: none"> 1. Install security devices. 2. Configure security devices 3. Conduct test

OVERVIEW OF COMPETENCY STANDARDS FOR COMPUTER HARDWARE & NETWORK TECHNICIAN (NC3)

UNIT TITLE	ELEMENTS OF COMPETENCE
Perform installation and configuration of server	<ol style="list-style-type: none">1. Install server.2. Configure server3. Conduct test
Perform monitoring and administration of network security	<ol style="list-style-type: none">1. Control user accounts.2. Secure file and resource access.3. Monitor threats to network system

UNIT TITLE : Perform installation and configuration of computer system and devices

DESCRIPTOR: This unit covers the competencies required to install systems and devices, configure system & devices and to conduct test on computer system and devices.

CODE : 3511-U1-L2

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Install systems & devices	<ul style="list-style-type: none">1.1 Identify customers' requirements and identify additional devices as per the job requirements.1.2 Select and use PPE as per the job requirements.1.3 Estimate the quantity of materials and are obtained as per the job requirements.1.4 Obtain tools and equipment needed to carry out the installation work in accordance with established procedures and checked for correct operation and safety.1.5 Check the compatibility of the new devices with the existing computer system and with internal devices in accordance with system specifications.1.6 Determine location in which devices / systems are to be installed as per the job requirements.1.7 Remove existing incompatible device drivers conflicting the installation as per the job requirements.1.8 Install devices correctly in accordance with requirements, without damage or distortion to the surrounding environment or services.1.9 Install drivers, where necessary as per the job requirements.

	<p>1.10 Carry out variation to devices and drivers installation in accordance to customer/client requirements.</p> <p>1.11 Respond to unplanned events or conditions in accordance with established procedures.</p> <p>1.12 Undertake on-going checks of the quality of the work in accordance with established procedures.</p> <p>1.13 Document the details of installation works/devices as per the standard procedures.</p>
<p>2. Configure system and devices</p>	<p>2.1 Identify and collect required tools and equipment in accordance with job requirements and are checked for correct operation and safety.</p> <p>2.2 Identify and collect PPE as per the job requirements.</p> <p>2.3 Identify computer systems and devices to be configured from the Job/Service Order or instructions.</p> <p>2.4 Check computer systems and devices for configuration against specifications and requirements.</p> <p>2.5 Obtain materials necessary to complete the work in accordance with established procedures and checked against job requirements.</p> <p>2.6 Check for normal functioning of systems and devices in accordance with manufacturer's instructions.</p> <p>2.7 Diagnose fault or problem in the computer systems and devices as per the job requirements.</p> <p>2.8 Configure computer systems and device in line with the standard operating procedures.</p> <p>2.9 Respond to unplanned events or conditions in accordance with established procedures</p>

<p>3. Conduct test</p>	<p>3.1 Check system and devices for proper operation as per the job requirements.</p> <p>3.2 Make necessary adjustments & replacements as per the job requirements.</p> <p>3.3 Uninstalled drivers which are not required, if necessary as per the job requirements.</p> <p>3.4 Store / return parts or connections of the installation or service that are removed in accordance with established procedures.</p> <p>3.5 Undertake final inspections to ensure the installed devices / systems conforms to requirements.</p> <p>3.6 Document test results, if necessary in accordance with job requirements.</p>
------------------------	---

RANGE STATEMENT

- PPE may include but not limited to:**
- Goggles
 - Safety shoes
 - Mask
 - Company dress
 - Gloves

- Materials may include but not limited to:**
- Soldering iron & lead
 - Drivers
 - Operating system CDs/USB
 - Flux

- Tools and equipment may include but not limited to:**
- Multi-meter
 - Desoldering tool
 - Wire stripper
 - Allen key
 - Pliers
 - IC insertion / extraction tool
 - Screw drivers

- Devices may include but not limited to:**
- Monitor
 - Hubs
 - Motherboard
 - Switches
 - Printers
 - LAN cards
 - Scanners
 - Storage devices

Critical Aspects:

- Demonstrate compliance with safety regulation applicable to work site operation.
- Installation of system and devices as per the customer's requirements.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none">• Ethic and integrity• Occupational Health and Safety (OHS) Regulations• Types of operating system• Basic knowledge of electronic components• Basic First Aid• Types and uses of PPE• Parts and devices of computer• Basic estimation and costing	<ul style="list-style-type: none">• Team work• Interpersonal relationship• Problem solving• Creativity & innovative thinking• Continuous learning

UNIT TITLE : Perform troubleshooting of computer system and devices.

DESCRIPTOR: This unit covers the competencies required to diagnose and rectify faults in computer system and devices.

CODE : 3511-U2-L2

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Diagnose faults	1.1 Select and use PPE as per the job requirements. 1.2 Identify faults or problems in the computer systems and devices according to requirements and in line with the standard operating procedures. 1.3 Estimate the cost of repair as per the job requirements. 1.4 Communicate with the customer regarding the faults and repairs required as per the job requirement. 1.5 Obtain tools and equipment needed to carry out the installation work in accordance with established procedures and checked for correct operation and safety. 1.6 Backup necessary data and configuration following standard procedures as per the job requirements.
2. Rectify faults	2.1 Replace or repair defective components or parts without damage to the surrounding environment or services following standard procedure. 2.2 Repair or reinstall the application software as per the job requirement following standard procedures.

	<p>2.3 Make adjustments, if necessary in accordance with standard operating procedures.</p> <p>2.4 Test computer systems and devices to ensure safe operation following standard procedure.</p> <p>2.5 Restore necessary data and configuration following standard procedures as per the job requirements.</p> <p>2.6 Prepare report/s, if necessary according to establishment procedures.</p>
--	---

RANGE STATEMENT	
PPE may include but not limited to:	
<ul style="list-style-type: none"> • Goggles • Mask • Gloves 	<ul style="list-style-type: none"> • Safety shoes • Company dress
Tools & Equipment may include but not limited to:	
<ul style="list-style-type: none"> • Multi-meter • Wire stripper • Pliers • Screw drivers • LAN tester 	<ul style="list-style-type: none"> • Soldering / Desoldering tool • IC insertion / extraction tool • Tweezers • Crimping tools
Devices may include but not limited to:	
<ul style="list-style-type: none"> • Monitor • Motherboard • Printers • Scanners 	<ul style="list-style-type: none"> • Hubs • Switches • LAN cards • Storage devices
Faults may include but not limited to:	
<ul style="list-style-type: none"> • System faults 	<ul style="list-style-type: none"> • Software faults

Critical Aspects:

- Demonstrate compliance with safety regulation applicable to work site operation.
- Diagnose and rectify the faults ensuring data backup as per the job requirements following standard procedures.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none">• Ethic and integrity• Occupational Health and Safety (OHS) Regulations• Basic electronic components• Basic First Aid• Types and uses of personal protective equipment• Ports and connectors• Hardware & Software components• E-waste• Basic estimation and costing	<ul style="list-style-type: none">• Safe use of tools and equipment• Team Work• Communication• Problem solving• Creativity and innovative

UNIT TITLE : Perform installation and configuration of network

DESCRIPTOR: This unit covers the competencies required to install, configure and conduct network test.

CODE : 3511-U3-L2

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Install network	<p>1.1 Identify customers' requirements considering compatibility with existing application software and operating system.</p> <p>1.2 Analyze and evaluate the customers' requirements following standard procedures.</p> <p>1.3 Read and interpret network diagram as per the job requirement following standard procedure.</p> <p>1.4 Select and use PPE as per the job requirements.</p> <p>1.5 Estimate the quantity of materials and are obtained as per the job requirements.</p> <p>1.6 Estimate installation cost as per the standard procedures.</p> <p>1.7 Obtain tools and equipment needed to carry out the installation work in accordance with established procedures and checked for correct operation and safety.</p> <p>1.8 Review existing network system as per the job requirements.</p> <p>1.9 Install network in accordance with correct installation procedures, with minimal disruption to the services.</p> <p>1.10 Install drivers, where necessary as per the job requirements.</p>

<p>2. Configure network</p>	<p>2.1 Identify computer systems and devices to be configured as per the job requirements.</p> <p>2.2 Determine the network type as per the customer's requirements following standard procedure.</p> <p>2.3 Check devices for configuration against specifications and requirements.</p> <p>2.4 Determine and assign the IP address as per the job requirements.</p> <p>2.5 Configure network setting as per network type following correct configuration procedures.</p> <p>2.6 Configure software, if necessary following correct configuration procedures.</p>
<p>3. Conduct test</p>	<p>3.1 Test the installation and configuration to ensure that it meets the needs as per the job requirements.</p> <p>3.2 Prepare report, if necessary as per the job requirements.</p> <p>3.3 Store / return parts or connections of the installation or service that are removed in accordance with established procedures.</p>

RANGE STATEMENT	
<p>PPE may include but not limited to:</p> <ul style="list-style-type: none"> • Goggles • Mask • Gloves • Company dress • Safety shoes 	
<p>Materials / devices may include but not limited to:</p> <ul style="list-style-type: none"> • Network cards • Switches • Cables (Fiber/CAT 6) • RJ45 connectors • Modem • Routers • Casing and capping • Fiber joint box • Fiber patch cord • Media converter/ONU/FODP /joint sleeve 	

Tools and equipment may include but not limited to:

- Multi-meter
- Crimping tools
- Wire stripper
- Punching tools
- Power backup
- Screw drivers
- LAN tester
- Fiber optic machine
- OTDR machine/Laser light

Network may include but not limited to:

- LAN (Local Area Network)
- WAN (Wide Area Network)
- CAN (Campus Area Network)

Drivers may include but not limited to:

- Network Interface card drivers
- Device drivers (NIC)

Critical Aspects:

- Demonstrate compliance with safety regulation applicable to work site operation.
- Installation of range of networks following correct installation procedures to the customer's requirements.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none">• Ethic and integrity• Occupational Health and Safety (OHS) Regulations• Types of operating system• Basic knowledge of electronic components• Basic estimation and costing	<ul style="list-style-type: none">• Team Work• Communication• Interpersonal relationship• Problem solving• Negotiation• Creativity and innovative

<ul style="list-style-type: none">• Current industry network hardware, network connections• Basic First Aid• Basic script and coding system• IP calculation• Routing concepts	
---	--

UNIT TITLE : Perform maintenance of computer systems and network

DESCRIPTOR: This unit covers the competencies required to prepare maintenance work and to carryout maintenance.

CODE : 3511-U4-L2

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Prepare for maintenance work.	1.1 Conduct mapping of network as per the job requirement following standard procedure. 1.2 Identify and collect required tools and equipment in accordance with job requirements and are checked for correct operation and safety. 1.3 Check computer systems, devices and network for maintenance against specifications and requirements. 1.4 Obtain materials necessary to complete the work in accordance with established procedures and checked against job requirements. 1.5 Estimate maintenance cost as per the standard procedures. 1.6 Select appropriate storage media and backup data using correct procedures as per the job requirements
2. Carry out maintenance	2.1 Use appropriate personal protective equipment as per the job requirements. 2.2 Update application software as job requirements following standard procedures. 2.3 Check hardware associated with computer system and take necessary action as per the job requirements.

	<p>2.4 Check hardware associated with network and take necessary action as per the job requirements.</p> <p>2.5 Check operation of any new devices for compatibility with existing hardware / software as per the standard procedures.</p> <p>2.6 Respond to unplanned events or conditions in accordance with established procedures.</p> <p>2.7 Prepare report in accordance with establishment requirements.</p>
--	---

RANGE STATEMENT	
PPE may include but not limited to:	
<ul style="list-style-type: none"> • Goggles • Mask • Safety shoes • Helmet 	<ul style="list-style-type: none"> • Gloves • Company Dress • Anti-static wrist band
Tools and equipment may include but not limited to:	
<ul style="list-style-type: none"> • Multi-meter • Crimping tools • Wire stripper • Punching tools • Screw drivers 	<ul style="list-style-type: none"> • LAN tester • Fiber optic machine • OTDR machine/Laser light • Power backup
Computer systems and devices may include but not limited to:	
<ul style="list-style-type: none"> • Monitor • Hubs • Servers • Switches 	<ul style="list-style-type: none"> • Printers • LAN cards • Scanners
Storage media may include but not limited to:	
<ul style="list-style-type: none"> • Hard disk • USB drive 	<ul style="list-style-type: none"> • CDs

Critical Aspects:

- Demonstrate compliance with safety regulation applicable to work site operation.
- Maintain computer system and devices as per the job requirements.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none">• Ethic and integrity• Occupational Health & Safety• Basic electronics components• Basic First Aid• Basic estimation and costing• Software components	<ul style="list-style-type: none">• Team Work• Communication• Interpersonal relationship• Problem solving• Negotiation• Creativity and innovative

UNIT TITLE : Perform installation and configuration of physical security devices

DESCRIPTOR: This unit covers the competencies required to install security devices, configure security devices and to conduct test on physical security devices.

CODE : 3511-U5-L2

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Install security devices.	1.1 Identify and collect required tools and equipment in accordance with job requirements and are checked for correct operation and safety. 1.2 Identify and use PPE as per the job requirements. 1.3 Identify and collect required materials / devices as per the job requirements. 1.4 Identify the surveillance area as per the job requirements in consultation with the clients. 1.5 Estimate installation cost as per the standard procedures. 1.6 Install security devices following correct installation procedures. 1.7 Install application software as per the job requirements.
2. Configure security devices	2.1 Identify security devices to be configured as per the job requirements 2.2 Check security devices for configuration against specifications and requirements. 2.3 Configure storage / record setting as per customer's specifications. 2.4 Configure software, if necessary following correct configuration procedures.

	2.5 Test configuration and make minor adjustment if necessary as per the job requirements.
3. Conduct test	<p>3.1 Test the installation and configuration of security devices to ensure that it meets the needs as per the job requirements.</p> <p>3.2 Prepare report, if necessary as per the job requirements.</p>

RANGE STATEMENT

PPE may include but not limited to:

- Goggles
- Mask
- Safety shoes
- Gloves
- Company dress
- Anti-static wrist band

Tools and equipment may include but not limited to:

- Drilling machine
- Pliers
- Crimping tools
- Multi meter
- Cutting pliers
- Screw driver set

Materials / devices may include but not limited to:

- Operating system
- Storage devices
- Application software
- Cables/fiber
- CCTV camera
- Clips
- Monitor
- DVRs / NVRs
- Casing
- Hard disk
- PPOE switch
- RJ45 connectors
- Media convertor
- Patch cord

Critical Aspects:

- Demonstrate compliance with safety regulation applicable to work site operation.
- Install security system devices as per the job requirements following standard procedure.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none">• Ethic and integrity• Types of physical security devices• Occupational Health and Safety (OHS) Regulations• Basic knowledge of electronic components• Current domestic/ industry security devices• Basic First Aid• Basic estimation and costing• Types and specification of cameras	<ul style="list-style-type: none">• Proper use of tools• Team Work• Communication• Interpersonal relationship• Problem solving• Creativity and innovation

UNIT TITLE : Perform installation & configuration of server

DESCRIPTOR: This unit covers the competencies required to install, configure and conduct test on server,

CODE : 3511-U6-L3

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Install server.	1.1 Identify and collect required tools and equipment in accordance with job requirements and are checked for correct operation and safety. 1.2 Identify and collect required resources as per the job requirements. 1.3 Estimate installation cost as per the standard procedures. 1.4 Install operating system following correct installation procedures. 1.5 Install application software as per the job requirements.
2. Configure server	2.1 Identify computer systems and devices to be configured as per the job requirements. 2.2 Determine the network type as per the customer's requirements. 2.3 Check devices for configuration against specifications and requirements. 2.4 Determine and assign the IP address as per the job requirements. 2.5 Configure network setting as per network type following correct configuration procedures. 2.6 Configure software, if necessary following correct configuration procedures.

	<p>2.7 Test configuration and make minor adjustment if necessary as per the job requirements.</p> <p>2.8 Restore data as per the job requirements following standard procedures.</p>
3. Conduct test	<p>3.1 Test the server for functionality as per the job requirements following standard procedure.</p> <p>3.2 Prepare report, if necessary as per the job requirements.</p>

RANGE STATEMENT	
PPE may include but not limited to:	
<ul style="list-style-type: none"> • Goggles • Gloves • Mask 	<ul style="list-style-type: none"> • Company dress • Safety shoes • Anti-static wrist band
Resources may include but not limited to:	
<ul style="list-style-type: none"> • Operating system 	<ul style="list-style-type: none"> • Application software
Operating system may include but not limited to:	
<ul style="list-style-type: none"> • Windows server 	<ul style="list-style-type: none"> • Open source (Linux)
Critical Aspects:	
<ul style="list-style-type: none"> • Demonstrate compliance with safety regulation applicable to work site operation. • Install server as per the job requirements following standard procedure. 	

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> • Ethic and integrity • Types of server 	<ul style="list-style-type: none"> • Proper use of tools • Team Work

<ul style="list-style-type: none">• Occupational Health and Safety (OHS) Regulations• Types of operating system• Basic knowledge of electronic components• Current industry servers• Basic First Aid	<ul style="list-style-type: none">• Communication• Interpersonal relationship• Problem solving• Creativity and innovation
--	--

UNIT TITLE : Perform monitoring and administration of network security

DESCRIPTOR: This unit covers the competencies required to control user accounts, secure files & resource access and to monitor threats to network system.

CODE : 3511-U7-L3

ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Control user accounts.	1.1 Create password policies as per the job requirements. 1.2 Create user accounts as per the job requirements. 1.3 Review and monitor user network access as per the job requirements.
2. Secure file & resource access.	2.1 Review inbuilt security and access features of the operating system and document areas of concern as per the job requirements. 2.2 Analyze the file security system and upgrade it, if necessary in accordance with job requirements. 2.3 Implement process for ongoing updates of virus as per the job requirements. 2.4 Implement inbuilt or additional encryption facilities to ensure security of resources as per the job requirements.
3. Monitor threats to network system	3.1 Investigate the current network security system as per the job requirements 3.2 Carry out spot checks and other activities to ensure network security as per job requirements. 3.3 Attain to threats as per the job requirements. 3.4 Document findings as per the job requirements.

RANGE STATEMENT

Threats may include but not limited to:

- Virus
- Malware
- Hacking

Critical Aspects:

- Demonstrate compliance with safety regulation applicable to work site operation.
- Monitor and administer network security system.

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none">• Ethic and integrity• Occupational Health and Safety (OHS) Regulations• Types of server• Types of operating system• Current industry network security systems• Basic First Aid• Monitoring procedures• Server backup• Cyber security	<ul style="list-style-type: none">• Proper use of tools• Team Work• Communication• Interpersonal relationship• Problem solving• Creativity and innovation