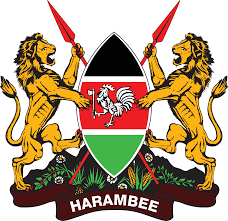
****

**REPUBLIC OF KENYA**

**COMPETENCY BASED MODULAR CURRICULUM**

**FOR**

**NETWORK SYSTEM ADMINISTRATION**

**KNQF LEVEL 6**

**PROGRAMME CODE: 0612 554A**

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# FOREWORD

The provision of quality education and training is fundamental to the Government’s overall strategy for social and economic development. Quality education and training contribute to the achievement of Kenya’s development blueprint and sustainable development goals.

Reforms in the education sector are necessary to achieve Kenya Vision 2030 and meet the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution, and this resulted in the formulation of the Policy Framework for Reforming Education and Training in Kenya (Sessional Paper No. 14 of 2012). A key feature of this policy is the radical change in the design and delivery of TVET training. This policy document requires that training in TVET be competency-based, curriculum development be industry-led, certification be based on demonstration of competence, and the mode of delivery allow for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that this curriculum has been developed. For trainees to build their skills on foundational hands-on activities of the occupation, units of learning are grouped in modules. This has eliminated duplication of content and streamlined exemptions based on skills acquired as a trainee progresses in the up-skilling process, while at the same time allowing trainees to be employable in the shortest time possible through the acquisition of part qualifications.

It is my conviction that this curriculum will play a great role in developing competent human resources for the ICT Sector’s growth and development.

**PRINCIPAL SECRETARY**

**STATE DEPARTMENT FOR TVET**

**MINISTRY OF EDUCATION**

**PREFACE**

Kenya Vision 2030 aims to transform Kenya into a newly industrializing middle-income country, providing high-quality life to all its citizens by the year 2030. Kenya intends to create globally competitive and adaptive human resource base to meet the requirements of a rapidly industrializing economy through lifelong education and training. TVET has a responsibility to facilitate the process of inculcating knowledge, skills, and worker behaviour necessary for catapulting the nation to a globally competitive country, hence the paradigm shift to embrace Competency-Based Education and Training (CBET).

TVET Act, CAP 210A and Sessional Paper No. 1 of 2019 on Reforming Education and Training in Kenya for Sustainable Development emphasized the need to reform curriculum development, assessment, and certification. This called for a shift to CBET to address the mismatch between skills acquired through training and skills needed by industry, as well as increase the global competitiveness of the Kenyan labour force.

This curriculum has been developed in adherence to the Kenya National Qualifications Framework and CBETA standards and guidelines. The curriculum is designed and organized into Units of Learning with Learning Outcomes, suggested delivery methods, learning resources, and methods of assessing the trainee’s achievement. In addition, the units of learning have been grouped in modules to concretize the skills acquisition process and streamline upskilling.

I am grateful to all expert trainers and everyone who played a role in translating the Occupational Standards into this competency-based modular curriculum.

**COUNCIL CHAIRPERSON / QAI**

# ACKNOWLEDGEMENT

This curriculum has been designed for competency-based training and has independent units of learning that allow the trainee flexibility in entry and exit. In developing the curriculum, significant involvement and support were received from expert trainers, institutions and organizations.

I recognize with appreciation the role of the ICT National Sector Skills Committee (NSSC) in ensuring that competencies required by the industry are addressed in the curriculum. I also thank all stakeholders in the ICT sector for their valuable input and everyone who participated in developing this curriculum.

I am convinced that this curriculum will go a long way in ensuring that individuals aspiring to work in the ICT Sector acquire competencies to perform their work more efficiently and effectively.

**COUNCIL SECRETARY/ CEO**

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# ABBREVIATION AND ACRONYMS

CAD Computer-Aided Design

CCTV Closed Circuit Television

CD Compact Disc

CPU Central Processing Unit

CV Curriculum Vitae

DVD Digital Versatile Disc

DVI Digital Visual Interface

ERP Enterprise Resource Planning

HDMI High-Definition Multimedia Interface

ICT Information Communication Technology

IEEE Institute of Electrical and Electronics Engineers

IP Internet Protocol

KCSE Kenya Certificate of Secondary Education

KNQA Kenya National Qualification Authority

KNQF Kenya National Qualification Framework

LAN Local Area Network

MAC Media Access Control

NOS Network Operating System

POST Power on Self-Test

PRTG Paessler Router Traffic Grapher

QOS Quality of Service

RAM Random Access Memory

SFP Small Form-factor Pluggable

SNMP Simple Network Management Protocol

TVET Technical and Vocational Education and Training

TVETA Technical and Vocational Education and Training Authority

URI Uniform Resource Identifier

URL Uniform Resource Locator

USB Universal Serial Bus

UTP Unshielded Twisted Pair

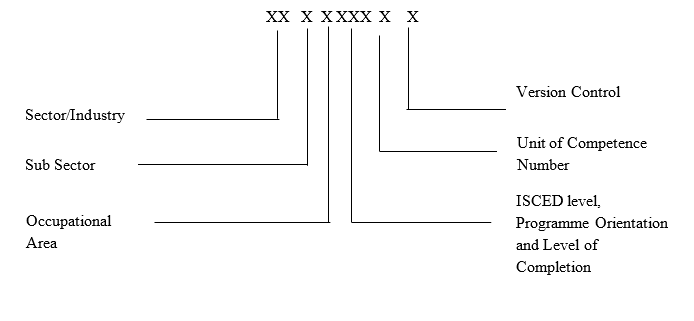
VGA Video Graphics Array

VM Virtual Machine

VLAN Virtual Local Area Network

WAN Wide Area Network

**KEY TO UNIT CODE**



# COURSE OVERVIEW

Network system administration level 6 curriculum prepares learners with the technical skills and the knowledge needed in network designing and administration. It comprises of basic learning in work ethics and practices, communication skills and entrepreneurial skills. In addition, this curriculum entails the following foundation common units; computer repair and maintenance, basic electronics and discrete mathematical concepts. Core units include; computer network design, computer network setup, computer network software installation, computer network security configuration, computer network maintenance, computer network security monitoring, computer system administration, computer system administration, database administration and system virtualization. Therefore, a network system administrator is a well-trained person who can carry out these duties.

These responsibilities comprise the units of competency of a network system administrator level 6 which include the following basic, common and core competencies:

**SUMMARY OF UNITS OF COMPETENCY**

**MODULAR UNIT SUMMARY**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **MODULE** | **UNITS** | | | |  |
| **UNIT**  **CATEGORY** | **UNIT CODE** | **UNIT NAME** | **DURATION**  **(Hours)** | **CREDIT FACTORS** |
| **ONE (I)** | **COMMON** | 0611 441 01A | Computer Applications | 90 | 9.0 |
| **CORE** | 0612 451 05A | Computer Network Design | 200 | 20.0 |
| **COMMON** | 0714 451 03A | Computer Repair and Maintenance | 130 | 13.0 |
|  |  | **Total** | **420** | **42.0** |
| **TWO (2)** | **CORE** | 0612 451 06A | Computer Network Setup | 200 | 20.0 |
| **CORE** | 0612 451 07A | Computer Network Software Installation | 200 | 20.0 |
|  |  | **Total** | **400** | **40.0** |
| **THREE (3)** | **CORE** | 0612 451 08A | Computer Network Security Configuration | 210 | 21.0 |
| **CORE** | 0612 451 09A | Computer Network Maintenance | 210 | 21.0 |
|  |  | **Total** | **420** | **42.0** |
| **FOUR (4)** | **CORE** | 0612 451 10A | Computer Network Security Monitoring | 220 | 22.0 |
| **COMMON** | 0714 441 04A | Basic Electronics | 100 | 10.0 |
| **BASIC** | 0417 451 02A | Work Ethics and  Practices | 40 | 4.0 |
|  |  | **Total** | **360** | **36.0** |
| **FIVE (5)** | **COMMON** | 0541 551 03A | Discrete Mathematical Concepts | 160 | 16.0 |
|  | **CORE** | 0612 551 04A | Computer System Administration | 220 | 22.0 |
|  | **BASIC** | 0031 551 01A | Communication Skills | 40 | 4.0 |
|  |  |  | **Total** | **420** | **42.0** |
| **SIX (6)** | **CORE** | 0612 551 05A | Database Administration | 220 | 22.0 |
|  | **CORE** | 0612 551 06A | System Virtualization | 220 | 22.0 |
|  | **BASIC** | 0732 551 02A | Entrepreneurial Skills | 40 | 4.0 |
|  |  |  | **Total** | **480** | **48.0** |
|  |  |  | **INDUSTRIAL ATTACHMENT** | **480** | **48.0** |
|  |  |  | **GRAND TOTAL** | **2980** | **298.0** |

**Entry Requirements**

An individual entering this course should have any of the following minimum requirements:

1. Kenya Certificate of Secondary Education (KCSE) mean grade C - (Minus)

**Or**

1. Any other equivalent qualification determined by TVETA

**Trainer Qualification**

A trainer for any of the units of competency in this course must:

1. Have a minimum a KNQF Level 7 qualification of its equivalent in a trade area related to this course.
2. Be registered by TVETA.

**Industry Training**

An individual enrolled in this course will be required to undergo Industry training for a minimum period of 480 hours in ICT sector. The industrial training may be taken after completion of all units for those pursuing the full qualification or be distributed equally in each unit for those pursuing part qualification. In the case of dual training model, industrial training shall be as guided by the dual training policy.

Assessment

The course will be assessed both in formative and summative as follows:

1. During formative assessment all performance criteria shall be assessed based on performance criteria weighting.
2. Number of formative assessments shall minimally be equal to the number of elements in a unit of competency.
3. During summative assessment basic and common units may be integrated in the core units or assessed as discrete units.
4. Theoretical and practical weighting for each unit of learning shall be as follows;
5. 30:70 for units in module one, module two, module three and module four.
6. 40:60 for units in module five and module six
7. Formative and summative assessments shall be weighted at 60% and 40% respectively in the overall unit of learning score

For a candidate to be declared competent in a unit of competency, the candidate must meet the following conditions:

1. Obtained at least 40% in theory assessment in formative and summative assessments.
2. Obtained at least 60% in practical assessment in formative and summative assessment where applicable.
3. Obtained at least 50% in the weighted results between formative assessment and summative assessment where the former constitutes 60% and the latter 40% of the overall score.
4. Assessment performance rating for each unit of competency shall be as follows:

|  |  |
| --- | --- |
| **MARKS** | **COMPETENCE RATING** |
| 80 -100 | Attained Mastery |
| 65 - 79 | Proficient |
| 50 - 64 | Competent |
| 49 and below | Not Yet Competent |
| Y | Assessment Malpractice/irregularities |

1. Assessment for Recognition of Prior Learning (RPL) may lead to award of part and/or full qualification.

**Certification**

A candidate will be issued with a Certificate of Competency upon demonstration of competence in a core unit of competency. To be issued with **Kenya National TVET certificate** in network system technician level 5 the candidate must demonstrate competence in all the units of competency as given in the qualification pack. A Statement of Attainment certificate may be issued upon demonstration of competence in a certifiable element within a unit.

The certificates will be issued by the Qualification Awarding Institution

# MODULE 1

|  |  |  |  |
| --- | --- | --- | --- |
| **UNIT**  **CATEGORY** | **UNIT CODE** | **UNIT NAME** | **DURATION**  **(Hours)** |
| **COMMON** | 0611 441 01A | Computer Applications | 90 |
| **CORE** | 0612 451 05A | Computer Network Design | 200 |
| **COMMON** | 0714 451 03A | Computer Repair and Maintenance | 130 |
|  |  | **Total** | **420** |

## COMPUTER APPLICATIONS

**UNIT CODE:** 0611 441 01A

**Duration of Unit:** 90 hours

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Apply Computer Applications

**Unit Description**:

This unit covers the competencies required in performing word processing, operating spreadsheet program, preparing PowerPoint presentation, performing document production and managing online resources.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **DURATION (HOURS)** |
| 1. Perform word processing | 30 |
| 1. Operate spreadsheet program | 25 |
| 1. Prepare PowerPoint presentation | 15 |
| 1. Perform document production | 10 |
| 1. Manage online resources | 10 |
| **TOTAL** | **90** |

**Learning outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Perform word processing | * 1. Ergonomics risk factors   2. Creation of word document      1. Introduction to word processing      2. Types of word processors      3. Creating word documents   3. Creating and manipulating tables      1. Inserting tables      2. Working with tables   4. Performing Mail merging   5. Inserting Word processing objects      1. Picture      2. Shapes      3. Table      4. Charts   6. Generating list of figures and table of content      1. List of figures      2. Table of content | * Practical * Oral questions * Written tests * Observation * Portfolio of evidence |
| 2. Operate spreadsheet programs | * 1. Creating Spreadsheet workbook      1. Introduction to spreadsheets      2. Types of spreadsheets programs      3. Components of a spreadsheet program   Cell data entries   * + 1. Formatting and editing worksheets   1. Performing Cell referencing      1. Relative      2. Absolute   2. Application of Formula and functions      1. Sum      2. Average      3. Max      4. Min      5. Rank   3. Generating Charts      1. Charts         1. Pie charts         2. Bar charts         3. Line graphs         4. Column graphs | * Practical * Oral questions * Written tests * Observation * Portfolio of evidence |
| 3.Prepare PowerPoint presentation | * 1. Creating PowerPoint slides      1. Introduction to PowerPoint      2. Types of presentation programs      3. Creation of PowerPoint slides      4. Slide layouts      5. Formatting and editing   2. Exhibiting Presentation views      1. Outline      2. Normal      3. Slide sorter      4. Notes page      5. Reading view   3. Performing animations transitions   4. Presenting Slideshow | * Practical * Oral questions * Written tests * Observation * Portfolio of evidence |
| 4. Document production | * 1. Printing documents      1. Introduction to document production      2. Types of printers      3. Document printing   2. Document scanning      1. Types of scanners      2. Document scanning   3. Document duplication | * Practical * Oral questions * Written tests * Observation * Portfolio of evidence |
| 5. Manage online resources | * 1. Online file transfer      1. Introduction to online resources      2. Creating up online user accounts      3. E-mailing      4. Teleconferencing   2. Online document processing      1. Online data entry      2. File conversion      3. Google documents      4. E- tasks      5. Online file transfer   3. Performing online collaboration      1. Introduction to online collaboration      2. Types of online collaboration tools         1. Video conferencing         2. Chatting         3. Cloud computing         4. Social media         5. Online calendar         6. Mailing | * Practical * Oral questions * Written tests * Observation * Portfolio of evidence |

**Suggested Delivery Methods**

* Demonstration by trainer
* Practical work by trainee
* Viewing of related videos
* Group discussions
* Direct instructions

**Recommended resources for 25 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Trainee: Item) |
| **A** | **Learning Materials** |  |  |  |
|  | Textbooks |  | 5 pcs | 5:1 |
|  | Flip Charts |  | 5 pcs | 5:1 |
|  | PowerPoint presentations | For trainer’s use |  |  |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Lecture/theory room |  | 1 | 25:1 |
|  | Computer laboratory |  | 1 | 25:1 |
| **C** | **Consumable materials** |  |  |  |
|  | Printing papers |  | 1 ream | 1:20 |
|  | Foolscaps |  | 1 ream | 1:20 |
|  | Toners |  | 2 pcs | 13:1 |
|  | Assorted colour of whiteboard markers |  |  |  |
| **D** | **Tools and Equipment** |  |  |  |
|  | Computers |  | 25 pcs | 1:1 |
|  | Projector |  | 1 pcs | 25:1 |
|  | Reprographic machines |  | 1 pcs | 25:1 |
|  | Scanner |  | 1 pcs | 25:1 |
|  | Printers |  | 2 pcs | 13:1 |
|  | Whiteboard |  | 1 pcs | 25:1 |
|  | Flash drives |  | 5 pcs | 5:1 |
|  | External Hard drive |  | 5 pcs | 5:1 |
|  | System Software suite |  | 5 pcs | 5:1 |
|  | Application Software suite |  | 5 pcs | 5:1 |
|  | Computer Repair Tool box |  | 5 | 5:1 |

## COMPUTER NETWORK DESIGN

**UNIT CODE:** 0612 451 05A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Design Computer Network

**Unit Duration: 20**0 Hours

**Unit Description**

This unit covers the competencies required to design a computer network. It involves performing computer network site survey, designing computer network topology and documenting the network design.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **Learning Outcomes** | **Duration (Hours)** |
| 1. Perform Computer network site survey | 60 |
| 1. Design Computer network topology | 100 |
| 1. Document Computer network design | 40 |
| **TOTAL** | **200** |

**Learning Outcomes, Content, and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Perform Computer network site survey | * 1. Evaluation of Network infrastructure      1. Introduction to computer networks      2. Advantages and disadvantages of computer networks      3. Purpose and scope of computer networks.         1. Scalability         2. Resilience         3. Quality of service         4. compatibility      4. Application of computer networks.      5. Types of computer networks.      6. Components of computer networks.      7. Types of computer networking transmission media.      8. Computer network topologies.   2. Identification of network needs      1. Conducting needs analysis      2. Advantages and disadvantages of network needs      3. Importance of network needs Communication         1. Resource sharing         2. Data sharing and collaboration         3. Internet access         4. Data back-up and recovery         5. Security         6. Fault tolerance and Redundancy   3. Fundamentals of Network Design      1. Key concepts of network design      2. Importance of network design      3. Factors to consider in network design         1. Security         2. Fault tolerance         3. High performance         4. Reliability         5. Number of users         6. Scalability         7. Performance         8. Flexibility         9. QOS         10. Accessibility      4. Network design tools         1. Software design tools   4. Computer network site layout design      1. Types of network sites      2. Factors to consider when designing a site layout      3. Site layout plan development   5. Computer network Transmission media      1. Introduction to transmission media      2. Categories of transmission media         1. Bound/wired         2. Unbound/wireless      3. Types of transmission media         1. Coaxial cable         2. Fibre Optic         3. Twisted pair cable         4. Satellite         5. Microwave      4. Selection criteria for transmission media   6. Computer network E-waste management      1. Definition of terms      2. Advantages and disadvantages of managing E-waste      3. Laws and regulations governing E-waste management in Kenya      4. Types of E-waste         1. Obsolete servers         2. Obsolete switches and routers         3. Networking cables and connectors         4. Obsolete computers and computer accessories      5. Procedures for disposing E-waste   7. Green energy in computer networking      1. Key concepts in green energy      2. Designing sustainable computer network         1. Renewable energy sources         2. Energy efficient hardware         3. Virtualization and Consolidation         4. Energy aware routing         5. Energy monitoring and reporting      3. Pros and cons of green energy in computer networking | * Practical Assessment * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written Assessment * Case study |
| 1. Design Computer network topology. | * 1. Network plan design.      1. Floor design      2. Wireless design   2. Tools and components for designing computer networks.      1. Tools for designing computer networks         1. Software tools      2. Computer network components and their functions         1. Gateways         2. NIC         3. Router         4. Switch         5. Modem         6. Firewall         7. Wireless access point         8. Repeaters   3. Determining network device location      1. IEEE Standards Requirements      2. Determining Device location Placement         1. Switch         2. Router         3. Wireless Access points   4. Computer network topology design      1. Key Concepts      2. Types of network topology         1. Star         2. Ring         3. Bus         4. Mesh         5. Hybrid      3. Criteria for selecting network topology design | * Practical Assessment * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written Assessment * Case study |
| 1. Document Computer network configurations | * 1. Computer Network documentation policy.(IEEE 802.11, 802.3)      1. Network performance report      2. Security report      3. Inventory report      4. Usage report      5. Incident report   2. Computer Network topology diagram      1. Physical topology diagrams   3. Network Mapping documentation      1. Device names, roles and IP address documentation. | * Practical Assessment * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written Assessment * Case study |

**Suggested Methods of delivery**

* Role playing
* Viewing of related videos
* Group discussions.
* Instructor led facilitation using active learning strategies.
* Projects.
* Demonstrations.
* Site visits.

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Trainee: Item) |
| **A** | **Learning Materials** | | | |
|  | Textbooks |  | 13 pcs | 2:1 |
|  | Installation manuals |  |  |  |
|  | Flip Charts |  |  |  |
|  | PowerPoint presentations | For trainer’s use |  |  |
| **B** | **Learning Facilities & infrastructure** | | | |
|  | Lecture/theory room |  | 1 | 25:1 |
|  | Laboratory |  | 1 | 25:1 |
| **C** | **Consumable materials** | | | |
|  | Printing papers |  | 1 ream | 1:20 |
|  | Toners/Cartridges |  | 2 pcs | 13:1 |
|  | Assorted colour of whiteboard markers |  |  |  |
| **D** | **Tools and Equipment** | | | |
|  | Computers |  | 25 pcs | 1:1 |
|  | Projector |  | 1 pc | 25:1 |
|  | Signal testers |  | 5 pcs | 5:1 |
|  | Header checker |  | 25 pcs | 1:1 |
|  | Crimping tools |  | 13 pcs | 2:1 |
|  | Cable tester |  | 5 pcs | 5:1 |
|  | Punch Downs |  | 5 pcs | 5:1 |
|  | Switches |  | 5pcs | 5:1 |
|  | Repeaters |  | 5pcs | 5:1 |
|  | Routers/modem |  | 5pcs | 5:1 |
|  | Network tool kit |  | 25 pcs | 1:1 |
|  | Gateways |  | 5pcs | 5:1 |
|  | Packets of RJ45 |  | 300 pcs | 1:10 |
|  | Fibre Modules (SFP) |  | 5pcs | 5:1 |
|  | UTP Ethernet Cable |  | 300 meters | 1:10 |
|  | Antistatic gloves |  | 25 pairs | 1:1 |

## COMPUTER REPAIR AND MAINTENANCE

**UNIT CODE:** 0714 451 03A

**Duration of Unit:** 130 Hours

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Perform Computer Repair and Maintenance

**Unit Description**

This unit covers the competencies required for performing computer repair and maintenance. It involves performing computer troubleshooting, repairing faulty components, testing computer component functionality and performing computer maintenance.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **Learning Outcomes** | **Duration (Hours)** |
| 1. Computer troubleshooting | 20 |
| 1. Faulty components | 50 |
| 1. Computer component functionality | 30 |
| 1. Computer maintenance | 30 |
| **TOTAL** | **130** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Perform computer troubleshooting | * 1. User data assessment      1. Introduction to computer repair and maintenance      2. Documenting faulty computer user data   2. Computer problems identification      1. Computer troubleshooting approaches      2. Basic computer hardware faults      3. Methods of information gathering      4. User data analysis   3. Determining solution to the problem      1. Computer hardware faults remedies      2. Test hypothesis      3. Problem Identification      4. Documentation of solution | * Practical assessment * Project * Observation Checklist * Product Checklist * Written assessment * Portfolio of evidence |
| 1. Repair faulty components. | * 1. Selection of computer components for replacement      1. Computer hardware components         1. Factors to consider in selecting computer components         2. computer hardware components parts acquisition   2. Assembly of tools for repairing or replacing      1. Computer repair and maintenance tools         1. Straight-head screwdriver, large and small         2. Phillips-head screwdriver, large and small         3. Tweezers or part retriever         4. Needle-nosed pliers         5. Wire cutters         6. Chip extractor         7. Hex wrench set         8. Torx screwdriver   3. Observation of Safety procedures      1. Safety measures and procedures         1. Personal Protective Equipment’s         2. Proper use of tools and equipment         3. Fire safety         4. Classes of fires         5. Fire extinguishers         6. Emergency procedures         7. First AID kit         8. Emergency contact         9. Contingency measures   4. Repair and replacing computer components      1. Computer components Instruction manuals      2. Computer components disassembly process      3. Reassembling repaired or replaced computer components   5. Disposing faulty or obsolete computer hardware components      1. Pollution      2. E- waste      3. Hazards      4. Types of E-waste      5. Proper disposal methods | * Practical assessment * Project * Observation Checklist * Product Checklist * Written assessment * Portfolio of evidence |
| 1. Test computer component functionality | * 1. Performing POST on computer   2. Performing computer component test      1. Importance of testing      2. Testing techniques         1. Testing of repaired or replaced components      3. Evaluation of test Results   3. Computer component’s functionality report      1. Generation of test results report | * Practical assessment * Project * Observation Checklist * Product Checklist * Written assessment * Portfolio of evidence |
| 1. Perform computer maintenance | 1. Computer maintenance scheduling    * 1. Introduction to computer maintenance         1. Definition of computer maintenance         2. Importance of computer maintenance      2. Types of computer maintenance      3. Prepare computer maintenance schedule 2. Performing computer maintenance    * 1. Computer maintenance utilities      2. Uses of computer maintenance utilities      3. Perform computer maintenance    1. Computer maintenance report       1. Importance of computer maintenance report       2. Components of computer maintenance report | * Practical assessment * Project * Observation Checklist * Product Checklist * Written assessment * Portfolio of evidence |

**Suggested Delivery Methods**

* Instructor led facilitation using active learning strategies
* Demonstration by trainer
* Practical work by trainee
* Viewing of related videos
* Group discussions
* Direct instructions

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  **(Trainee: Item)** |
| A | Learning Materials |  |  |  |
|  | Textbooks |  | 5 pcs | 5:1 |
|  | Installation manuals |  | 5 pcs | 5:1 |
|  | Flip Charts |  | 5 pcs | 5:1 |
|  | PowerPoint presentations | For trainer’s use |  |  |
|  | Magazines/brochures/business cards |  |  |  |
| B | Learning Facilities & infrastructure |  |  |  |
|  | Lecture/theory room |  | 1 | 25:1 |
|  | Computer Laboratory |  | 1 | 25:1 |
| C | Consumable materials |  |  |  |
|  | Printing papers |  | 1 ream | 1:20 |
|  | Foolscaps |  | 1 ream |  |
|  | Toners |  | 2 pcs | 13:1 |
|  | Assorted colour of whiteboard markers |  |  |  |
| D | Tools and Equipment |  |  |  |
|  | Computers |  | 25 pcs | 1:1 |
|  | Projector |  | 1 pcs | 25:1 |
|  | Printers |  | 2 pcs | 13:1 |
|  | Whiteboard |  | 1 pcs | 25:1 |
|  | Flash drives |  | 5 pcs | 5:1 |
|  | 1 External Hard drive |  | 1 pcs | 25:1 |
|  | Computer Repair Tool box |  | 5 | 5:1 |

# MODULE 2

|  |  |  |  |
| --- | --- | --- | --- |
| **UNIT**  **CATEGORY** | **UNIT CODE** | **UNIT NAME** | **DURATION**  **(HOURS)** |
| **CORE** | 0612 451 06A | Computer Network Setup | 200 |
| **CORE** | 0612 451 07A | Computer Network Software Installation | 200 |
|  | **Total** | | **400** |

## COMPUTER NETWORK SETUP

**UNIT CODE:** 0612 451 06A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Setup Computer Network

**Unit Duration**: 200 Hours

**Unit Description**

This unit covers the competencies required to setup a computer network. It involves setting up computer network, testing computer network connectivity, documenting computer network configurations and conducting computer network user training.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **DURATION (HOURS)** |
| 1. Setup Computer Network | 50 |
| 1. Test Computer Network Connectivity | 50 |
| 1. Document Computer Network Configurations | 50 |
| 1. Conduct Computer Network User Training | 50 |
| **TOTAL** | **200** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Setup computer network. | * 1. Network Components      1. Introduction to network components      2. Examples of network components         1. Router         2. Switch         3. Hub         4. Modem         5. Firewall         6. Access point         7. Server         8. Cable         9. Wireless adapter      3. Identifications of network tools         1. Crimping tool         2. Cable tester         3. Wire stripper         4. Multimeter         5. Screwdriver set         6. Ethernet cable and connectors   2. Networking standards      1. Introduction to Cable termination IEEE 802.3 standards      2. Type of cable termination standards         1. T568A,         2. T568B      3. Methods of cable termination         1. Crimped termination         2. Compression termination         3. Wire-wrap termination         4. Insulation displacement   3. Network components and network devices configuration as per IEEE standards * IP addressing * Routing configuration * Network security   + 1. Wireless network configuration | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |
| 1. Test Computer network connectivity | * 1. Network Component performance testing      1. Types of computer network component tests         1. Performance testing         2. Functionality testing         3. Security testing         4. Resilience and Recovery Testing         5. connectivity testing         6. Media testing         7. Bandwidth testing   2. Network Performance test   3. Network testing reports      1. Types of network reporting.         1. Network performance test report         2. Security vulnerability assessment report         3. Quality of service test report         4. Incidence response exercise report   4. Computer network Transmission media      1. Introduction to transmission media      2. Categories of transmission media         1. Bound/wired         2. Unbound/wireless      3. Types of transmission media         1. Coaxial cable         2. Fibre Optic         3. Twisted pair         4. Satellite         5. Microwave      4. Selection criteria for transmission media      5. Types of network transmission media testing         1. Cable continuity testing         2. Crosstalk test         3. Bandwidth and throughput testing         4. Signal quality testing         5. Wireless media testing | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |
| 1. Document Computer network configurations | * 1. Network component configuration documentation      1. Importance of network configuration documentation.      2. Types of documentations.         1. Device configuration         2. Network topologies         3. Security configuration.   2. Introduction Network data points      1. Types of Network Data Points         1. Ethernet ports         2. Coaxial cable outlets         3. Fibre optic terminals      2. Importance of Network Data Points      3. Factors to Consider When Installing Network Data Points      4. Common Applications of Network Data Points      5. Best practices for data points management   3. Labelling of Network topology designs | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study * Written tests * Case study |
| 1. Conduct Computer Network user training | * 1. Basic network navigation training      1. Importance of network user training.      2. Types of network training materials      3. Preparing for the network user training.      4. Types of user training.      5. Conducting network user training.   2. Network troubleshooting      1. Importance of network trouble shooting      2. Common issues in network trouble shooting      3. Network troubleshooting process      4. Network troubleshooting tools      5. Troubleshooting methodology   3. Data backup and recovery      1. Data identification and classification      2. Backup strategy design      3. Selection of backup solutions      4. Implementation of backup procedures      5. Regular backup execution      6. Monitoring and verification | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |

**Suggested Methods of delivery**

* Role playing
* Viewing of related videos
* Group discussions.
* Instructor led facilitation using active learning strategies.
* Projects.
* Demonstrations.
* Site visits.

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Trainee: Item) |
| **A** | **Learning Materials** | | | |
|  | Textbooks |  | 13 pcs | 2:1 |
|  | Installation manuals |  |  |  |
|  | Flip Charts |  |  |  |
|  | PowerPoint presentations | For trainer’s use |  |  |
| **B** | **Learning Facilities & infrastructure** | | | |
|  | Lecture/theory room |  | 1 | 25:1 |
|  | Laboratory |  | 1 | 25:1 |
| **C** | **Consumable materials** | | | |
|  | Printing papers |  | 1 ream | 1:20 |
|  | Toners/Cartridges |  | 2 pcs | 13:1 |
|  | Assorted colour of whiteboard markers |  |  |  |
| **D** | **Tools and Equipment** | | | |
|  | Computers |  | 25 pcs | 1:1 |
|  | Projector |  | 1 pc | 25:1 |
|  | Signal testers |  | 5 pcs | 5:1 |
|  | Header checker |  | 25 pcs | 1:1 |
|  | Crimping tools |  | 13 pcs | 2:1 |
|  | Cable tester |  | 5 pcs | 5:1 |
|  | Punch Downs |  | 5 pcs | 5:1 |
|  | Switches |  | 5pcs | 5:1 |
|  | Repeaters |  | 5pcs | 5:1 |
|  | Routers/modem |  | 5pcs | 5:1 |
|  | Network tool kit |  | 25 pcs | 1:1 |
|  | Gateways |  | 5pcs | 5:1 |
|  | Packets of RJ45 |  | 300 pcs | 1:10 |
|  | Fibre Modules (SFP) |  | 5pcs | 5:1 |
|  | UTP Ethernet Cable |  | 300 meters | 1:10 |
|  | Antistatic gloves |  | 25 pairs | 1:1 |

## COMPUTER NETWORK SOFTWARE INSTALLATION

**UNIT CODE:** 0612 451 07A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Install Computer Network Software

**Unit Duration:** 200 Hours

**Unit Description**

This unit covers the competencies required to install computer network software. It involves conducting network software simulation, performing computer software installation, testing computer network software and conducting computer network software user training and monitoring computer network software performance.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **DURATION (HOURS)** |
| 1. Conduct Network Software Simulation | 30 |
| 1. Perform Computer Network Software Installation | 30 |
| 1. Test Computer Network Software | 30 |
| 1. Conduct Computer Network Software User Training | 50 |
| 1. Monitor Computer Network Software Performance | 60 |
| **TOTAL** | **200** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Conduct Network Software Simulation   . | * 1. Computer network software requirements      1. Introduction to computer software      2. Computer network software         1. Network protocols and services         2. Operating systems         3. Network management software         4. Remote desktop software         5. Network backup and recovery software         6. VoIP software   2. Introduction to Installation and configuration of Computer network simulation Software      1. Types of Computer network simulation Software         1. Cisco (packet tracer)         2. Graphical Network Simulator         3. Wire shark      2. Uses of network simulators      3. Best practices in Installation and configuration of Computer network simulation Software   3. Basic Network Simulations activities      1. Simple Network Design      2. Troubleshooting Network Issues      3. Configuring Basic Protocols |  |
| 1. Perform Computer Network software installation | * 1. Network operating system Installation      1. Introduction to computer Network operating system      2. Functions of a NOS         1. File Sharing         2. Print Sharing         3. Resource Management         4. Security         5. Network Management      3. Features of Using a NOS         1. User authentication and authorization:         2. File and directory services         3. Network security         4. Backup and recovery         5. Remote management         6. Monitoring and reporting      4. Benefits of Using a NOS         1. Improved network performance         2. Enhanced security         3. Simplified network management         4. Increased collaboration         5. Cost savings   2. Network monitoring and management tools      1. Network management tools         1. FortiManager         2. OpManager Plus         3. Azure Virtual         4. WANQuantum Spark Security Management Portal      2. Network monitoring tools         1. Paessler PRTG Network Monitor         2. Progress WhatsUp Gold         3. Nagios XILogicMonitor         4. SolarWinds Network         5. Performance Monitor         6. Wireshark         7. Nagios         8. Zabbix         9. Cisco Prime Infrastructure   3. Network monitoring tools configuration      1. Types of network monitoring tools         1. Traffic monitoring tools         2. Performance monitoring tools         3. Security monitoring tools      2. Network monitoring tools configuration strategies | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |
| 1. Test Computer Network Software | * 1. Network Software Testing      1. Meaning and importance of software testing.      2. Types of computer network Software testing performed as per user requirements         1. Exploratory testing         2. Test case design         3. Defect reporting         4. Performance testing         5. Security testing         6. User acceptance testing         7. Functionality test      3. Continuous Improvement of Computer Network Software         1. Regular Reviews         2. Security Awareness         3. Training Incident Response Plan         4. Proactive Monitoring   2. Performing Corrective Actions on Computer Network Software      1. Corrective actions      2. Patch Management      3. Configuration Management      4. Security Measures      5. Network Troubleshooting      6. Performance Optimization      7. Backup and Recovery      8. Continuous Improvement of Computer Network Software         1. Regular Reviews         2. Security Awareness         3. Training Incident Response Plan         4. Proactive Monitoring   3. Introduction to Computer software functionality test report      1. Steps in conducting Computer software functionality test      2. Computer software Functional testing types         1. Unit testing         2. Smoke testing         3. User acceptance         4. Regression testing         5. Localization testing | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |
| 1. Conduct Computer Network software user training | * 1. User skill gap      1. Meaning of skill gap in computer networks      2. Identification of skill gap in computer networks   2. User training manuals      1. Definition of training manual      2. Types of computer network training manuals         1. Cisco network training manual         2. Microsoft certified network engineer associates         3. Linux network training manual   3. Network user training      1. Key Concepts Network user training         1. Basic network concepts and terminologies         2. Connecting to the networks         3. Network security best practices         4. Resources access and file sharing         5. Performance optimization   4. Training reports      1. Meaning and identification of computer networks training reports.      2. Types of computer networks training reports         1. Training evaluation report         2. Training completion report | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study * Written tests * Case study |
| 1. Monitor computer network software performance | * 1. Real-time network monitoring      1. Types of network software performance real –time monitoring.         1. SNMP         2. Packet sniffers         3. Performance monitoring tools         4. Flow-based analytics   2. Bandwidth and Throughput analysis      1. Definition of Bandwidth and Throughput      2. Factors Affecting Throughput analysis         1. Network Congestion         2. Network Congestion         3. Latency         4. Packet Loss         5. Protocol Overhead         6. Hardware Limitations      3. Tools for measuring and optimizing throughput and bandwidth      4. Network performance monitoring tools         1. Speed test applications         2. Quality of service         3. Traffic analysis         4. Bandwidth management and control tools         5. Predictive analytics and capacity planning tools      5. Best practices for managing bandwidth and throughput   3. Network Alerts and notifications      1. Types of Network Alerts and notifications         1. Security alerts         2. Performance alerts         3. Hardware alerts         4. Configuration alerts | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study * Written tests * Case study |

**Suggested Methods of delivery**

* Role playing
* Viewing of related videos
* Group discussions.
* Instructor led facilitation using active learning strategies.
* Projects.
* Demonstrations.
* Site visits.

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Trainee: Item) |
| **A** | **Learning Materials** | | | |
|  | Textbooks |  | 13 pcs | 2:1 |
|  | Installation manuals |  |  |  |
|  | Flip Charts |  |  |  |
|  | PowerPoint presentations | For trainer’s use |  |  |
| **B** | **Learning Facilities & infrastructure** | | | |
|  | Lecture/theory room |  | 1 | 25:1 |
|  | Laboratory |  | 1 | 25:1 |
| **C** | **Consumable materials** | | | |
|  | Printing papers |  | 1 ream | 1:20 |
|  | Toners/Cartridges |  | 2 pcs | 13:1 |
|  | Assorted colour of whiteboard markers |  |  |  |
| **D** | **Tools and Equipment** | | | |
|  | Computers |  | 25 pcs | 1:1 |
|  | Projector |  | 1 pc | 25:1 |
|  | Flash drives |  | 25 pairs | 1:1 |
|  | External CD/DVD drives |  | 13 pcs | 2:1 |

# MODULE 3

|  |  |  |  |
| --- | --- | --- | --- |
| **UNIT**  **CATEGORY** | **UNIT CODE** | **UNIT NAME** | **DURATION**  **(Hours)** |
| **CORE** | 0612 451 08A | Computer Network Security Configuration | 210 |
| **CORE** | 0612 451 09A | Computer Network Maintenance | 210 |
|  |  | **Grand total** | **420** |

## COMPUTER NETWORK SECURITY CONFIGURATION

**UNIT CODE:** 0612 451 08A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Configure Computer Network Security

**Unit Duration:** 210 Hours

**Unit Description**

This unit covers the competencies required to configure computer network security. It involves conducting computer network risk assessment, performing computer network segmentation, configuring computer network firewall and conducting computer network security user training.

**Summary of Learning Outcomes**

| **LEARNING OUTCOMES** | **DURATION (HOURS)** |
| --- | --- |
| 1. Conduct Computer Network Risk Assessment | 50 |
| 1. Perform Computer Network Segmentation | 60 |
| 1. Configure Computer Network Firewall | 60 |
| 1. Conduct Computer Network Security User Training | 40 |
| **TOTAL** | **210** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Conduct computer network risk assessment   . | * 1. Inventory of computer network      1. Introduction of computer network inventory.      2. Types of computer network inventory.         1. Hardware inventory         2. Software inventory         3. IP address inventory         4. Device configuration inventory   2. Identify and prioritize security threats and vulnerabilities      1. Introduction to computer network, security threats and vulnerabilities.      2. Categories of computer network, security threats         1. Internal (Outdated or unpatched software Misconfigured firewalls / operating systems, Denial of service, Man in the middle attack etc)         2. External (Malware attacks, Social engineering attacks, Phishing etc)      3. Types of computer network vulnerabilities.   3. Develop security Controls      1. Introduction to computer network security controls.      2. Types of computer network security controls.         1. Preventive         2. Detective controls         3. Corrective controls         4. Deterrent controls         5. Compensating controls         6. Administrative control         7. Logical/technical control         8. Physical controls         9. Technological controls   4. Risk assessment documentation      1. Meaning of computer network Risk Assessment Report      2. Types of computer network Risk Assessment Report.         1. Qualitative Risk Assessment Report         2. Quantitative Risk Assessment Report         3. Operation Risk Assessment Report | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |
| 1. Perform computer network segmentation | * 1. IP addressing scheme.      1. IP addressing and subnetting      2. IP address fundamentals         1. Physical address. MAC address.         2. Logical address. IP address.         3. Hostname.         4. IPv4 vs. IPv6         5. Classful addressing         6. Static vs. Dynamic IP Addressing         7. Public vs. Private IP Addresses      3. Steps in Designing an IP Addressing Scheme   2. Network segmentation      1. Introduction to network segmentation         1. Definition of network segmentation         2. Physical & logical segmentation         3. Importance of network segmentation      2. Types of network segmentation         1. IP based         2. VLANs         3. Subnetting         4. Firewalls         5. Physical segmentation      3. Tools and techniques for network segmentation         1. Firewalls, Routers, and Access Control Lists (ACLs)         2. Network Access Control (NAC)      4. Monitoring and Managing Network Segments   3. Network privileges.      1. Introduction to network privilege management         1. Definition of Network Privileges.         2. Roles of network privileges.      2. Types of Network Privileges:         1. Read, Write, Execute      3. Roles of Privilege Management in Network Security         1. Administrator privileges         2. User privileges         3. Read-only access         4. Remote access privileges      4. implementation of network access control      5. Understand Network Access Requirements      6. Develop Access Control Policies      7. Select a Network Access Control Solution | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |
| 1. Configure network firewall | * 1. Firewall security      1. Introduction to firewall security      2. Types of firewall security         1. Hardware firewall         2. Software firewall         3. Cloud firewall         4. Open-source firewall      3. Firewall architecture and components   2. Firewall Zone and IP address      1. Types of firewall zones      2. IP address structure         1. Network ID         2. Hosting ID   3. Access Control list      1. Network Access Control List (ACL)Concepts         1. Purpose of ACLs         2. Wildcard mask in ACLs         3. Types of IPv4 ACLs   4. Login and Firewall services      1. Firewall login and configuration concepts      2. Types of firewall services         1. Packet filtering         2. Stateful inspection         3. Application-level gateway         4. Virtualization   5. Firewall Configuration      1. Concepts of Firewall configuration      2. Steps of Firewall configuration      3. Best practices for firewall configuration      4. Objectives of firewall testing      5. Steps of Firewall testing      6. Tools for Firewall testing      7. Best practices for firewall testing   6. Firewall management      1. Concepts of firewall management         1. Firewall maintenance         2. Firewall monitoring         3. Compliance and auditing         4. Firewall documentation | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study * Written tests * Case study |
| 1. Conduct Computer Network security user training | * 1. Security Awareness      1. Introduction to computer network security awareness      2. User and customer training methods   2. Network security implementation      1. User training on implementation of Network security practices         1. Network security policies         2. Network security best practices         3. Network segmentation user training         4. Firewall implementation   3. Incidence Responses      1. User training on computer network incident response.      2. Types of computer network incident response      3. Components of incident response training for users      4. Incident response team functions and responsibilities   4. Regular updates      1. User training on computer networks regular updates.      2. Patch management   5. Network Compliance training      1. Concepts of computer networks Compliance training.      2. Legal and regulatory requirement.      3. Compliance policies and procedures      4. Compliance monitoring and auditing      5. Emerging trends in computer network compliance   6. Network testing and simulation      1. Introduction to network testing and simulation.      2. Components of network testing and simulation.         1. Network performance testing         2. Network security testing         3. Network simulation techniques | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |

**Suggested Methods of delivery**

* Role playing
* Viewing of related videos
* Group discussions.
* Instructor led facilitation using active learning strategies.
* Projects.
* Demonstrations.
* Site visits.

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**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Trainee: Item) |
| **A** | **Learning Materials** | | | |
|  | Textbooks |  | 13 pcs | 2:1 |
|  | Installation manuals |  |  |  |
|  | Flip Charts |  |  |  |
|  | PowerPoint presentations | For trainer’s use |  |  |
| **B** | **Learning Facilities & infrastructure** | | | |
|  | Lecture/theory room |  | 1 | 25:1 |
|  | Laboratory |  | 1 | 25:1 |
| **C** | **Consumable materials** | | | |
|  | Printing papers |  | 1 ream | 1:20 |
|  | Toners/Cartridges |  | 2 pcs | 13:1 |
|  | Assorted colour of whiteboard markers |  |  |  |
| **D** | **Tools and Equipment** | | | |
|  | Computers |  | 25 pcs | 1:1 |
|  | Projector |  | 1 pc | 25:1 |
|  | Flash drives |  | 25 pairs | 1:1 |
|  | External CD/DVD drives |  | 13 pcs | 2:1 |

## COMPUTER NETWORK MAINTENANCE

**UNIT CODE:** 0612 451 09A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Perform Computer Network Maintenance

**Unit Duration:** 210Hours

**Unit Description**

This unit covers the competencies required to perform computer network repair and maintenance. It involves analysing computer network performance, troubleshooting computer network components, performing computer network component repair and maintaining computer network.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **DURATION (HOURS)** |
| 1. Analyse Computer Network Performance | 40 |
| 1. Troubleshoot Computer Network Component | 70 |
| 1. Perform Computer Network Components Repair | 60 |
| 1. Maintain Computer Network | 40 |
| **TOTAL** | **210** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Analyze Computer Network Performance | * 1. Computer Network Traffic analysis.      1. Introduction to network traffic analysis      2. Concepts and metrics in network traffic analysis      3. Types of Network Traffic and Protocols      4. TCP/IP, UDP, ICMP and other common protocols         1. Unicast traffic         2. Broadcast traffic         3. Multicast traffic      5. Tools for Network Traffic Analysis         1. Wireshark,         2. tcpdump,         3. SolarWinds, NetFlow      6. Implementation of network traffic analysis         1. Locate all key network components         2. Using network monitoring software         3. Create alerts for component health and metrics         4. Bandwidth monitoring         5. Packet inspection         6. Performance optimization         7. Forensic analysis         8. Real-time monitoring and alerts   2. Network Bandwidth utilizationmonitoring      1. Introduction to Network Bandwidth Utilization      2. Definition of terms         1. Monitoring         2. bandwidth,         3. throughput,         4. latency,         5. packet loss      3. Bandwidth Monitoring Tools and Technologies         1. NetFlow,         2. PRTG,         3. SolarWinds         4. Web browsing monitoring         5. File downloads monitoring   3. Computer network Latency measurement      1. Introduction to Network Latency Measurement      2. Definition of terms         1. Network latency         2. jitter,         3. round-trip time (RTT)      3. Types of Latency and measurements      4. Tools for Network Latency Measurement         1. Ping         2. Traceroute         3. Wireshark         4. Network monitoring tools   4. Network Device performance monitoring      1. Introduction to Network Device Performance Monitoring      2. Importance of monitoring network devices      3. Network monitoring criteria         1. CPU usage,         2. Memory utilization,         3. Bandwidth,         4. Error rates      4. Key concepts for Monitoring Network Devices         1. Metrics tracking         2. Alerting         3. Real-time monitoring         4. Security monitoring         5. Latency, packet loss, error rates, and uptime         6. memory and CPU usage in network device      5. Network Device Performance Optimization Techniques      6. Optimizing device settings for better performance.      7. Implementing load balancing to reduce device load.      8. Adjusting network topology for optimal device performance. | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |
| 1. Troubleshoot computer network components | * 1. Basic Electronic skills      1. Introduction to basic electronic skills         1. Electricity and circuits Components         2. Electronic devices         3. Power supplies         4. Analog and Digital signals         5. Electronic measurement         6. Safety and practical considerations   2. Network component testing      1. Types of network components tests         1. Cable continuity test         2. Connectivity test         3. Performance test         4. Security test         5. Load test         6. Protocol test   3. Network Configuration verification      1. Concepts of Network configuration verification      2. Understanding network topologies      3. Device configuration checks      4. Network service configuration checks      5. Security configurations checks      6. Performance testing checks   4. Network Logging and error message review   5. Preparation of network troubleshooting Report | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |
| 1. Perform computer network component repair | * 1. Safety measures      1. Introduction to computer network Safety measures   2. Faulty network component      1. Importance of network maintenance      2. Types of computer network components faults         1. Switch faults         2. Router fault         3. Cabling faults         4. Server faults   3. Computer network problem-solving procedure      1. Network components Troubleshooting process      2. Types of network component repair   4. Network monitoring and maintenance tools   5. Faults Identifications      1. Procedures of identifying network faults      2. Types of network faults         1. Transmission errors         2. Network latency         3. Hardware faults         4. Protocol faults         5. Configuration errors         6. Data packet loss      3. Possible Solution for computer networks faults   6. Network component repair      1. General network components Repair procedures         1. Diagnosis         2. Isolation         3. Repair process         4. Documentation      2. Best practices for network component repair   7. E-waste Management      1. Network components disposal methods         1. Recycling         2. Donation         3. Incineration      2. Emerging trends in E-waste disposal | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study * Written tests * Case study |
| 1. Maintain computer network | * 1. Network Hardware and Software maintenance      1. Introduction to computer networks hardware and software maintenance      2. Types of hardware and software maintenance         1. Preventive         2. Adaptive         3. Corrective         4. Predictive   2. Network Monitoring      1. Concepts of Network monitoring and Performance optimization      2. Types of network monitoring         1. SNMP monitoring         2. Flow based monitoring         3. Packet capture and monitoring      3. Types Network monitoring tools      4. Best practices for network monitoring and performance optimization   3. Backup and disaster recovering      1. Introduction to network disaster recovery      2. Types of network backup         1. Full backup         2. Incremental backup         3. Deferential backup      3. Disaster recovery planning      4. Backup and disaster recovery tools      5. Best practices for backup and disaster recovery   4. Documentation and inventory maintenance      1. Types of documentation         1. Network documentation         2. Network inventory      2. Best practices for network documentation and inventory   5. Computer network compliance and regulatory updates      1. Common regulations affecting computer networks      2. Regulatory Updates in network compliance      3. Best practices forkeep up with compliance and regulatory updates         1. Regular audit and reviews         2. Continuous monitoring and threat detection      4. User training | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |

**Suggested Methods of delivery**

* Role playing
* Viewing of related videos
* Group discussions.
* Instructor led facilitation using active learning strategies.
* Projects.
* Demonstrations.
* Site visits.

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Trainee: Item) |
| **A** | **Learning Materials** | | | |
|  | Textbooks |  | 13 pcs | 2:1 |
|  | Installation manuals |  |  |  |
|  | Flip Charts |  |  |  |
|  | PowerPoint presentations | For trainer’s use |  |  |
| **B** | **Learning Facilities & infrastructure** | | | |
|  | Lecture/theory room |  | 1 | 25:1 |
|  | Laboratory |  | 1 | 25:1 |
| **C** | **Consumable materials** | | | |
|  | Printing papers |  | 1 ream | 1:20 |
|  | Toners/Cartridges |  | 2 pcs | 13:1 |
|  | Assorted colour of whiteboard markers |  |  |  |
| **D** | **Tools and Equipment** | | | |
|  | Computers |  | 25 pcs | 1:1 |
|  | Projector |  | 1 pc | 25:1 |
|  | Flash drives |  | 25 pairs | 1:1 |
|  | External CD/DVD drives |  | 13 pcs | 2:1 |

# MODULE 4

|  |  |  |  |
| --- | --- | --- | --- |
| **UNIT**  **CATEGORY** | **UNIT CODE** | **UNIT NAME** | **DURATION**  **(Hours)** |
| **CORE** | 0612 451 10A | Computer Network Security Monitoring | 220 |
| **COMMON** | 0714 441 04A | Basic Electronics | 100 |
| **BASIC** | 0417 451 02 A | Work Ethics and Practices | 40 |
| **TOTAL** | | | **360** |

## COMPUTER NETWORK SECURITY MONITORING

**UNIT CODE:** 0612 451 10A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Monitor Computer Network Security

**Unit Duration:** 220 Hours

**UNIT DESCRIPTION**

This unit covers the competencies required to monitor computer network security. It involves conducting computer network security assessment, monitoring computer network firewall activities and performing fundamental computer networking segmentation.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **DURATION (HOURS)** |
| 1. Conduct computer network security assessment | 50 |
| 1. Monitor Computer Network Firewall activities | 90 |
| 1. Perform fundamental Computer Network segmentation | 80 |
| **TOTAL** | **220** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Elements**  *These describe the key outcomes which make up workplace functions* | **Performance Criteria**  *These are assessable statements which specify the required level of performance for each of the elements*  **(Bold and italicized terms are elaborated in the range)** | **Suggested Assessment Methods** |
| 1. Conduct computer network security assessment | * 1. Network Security Threats & Vulnerabilities      1. Introduction to computer network security      2. Importance of computer network security         1. Preventing unauthorized access:         2. Protecting data integrity:         3. Ensuring business continuity:      3. Types of network security threats and vulnerabilities         1. Malware         2. Phishing         3. Man in the middle attack         4. Denial of service attack         5. SQL injection         6. Weak authentication and authorization         7. Physical security threats   2. Network Security Controls      1. Types of computer network security controls         1. Preventive controls         2. Detective controls         3. Corrective controls      2. Implementation of computer network security controls         1. Physical controls * Lock & Keys * Biometrics * Access Cards & Badges * CCTVs   + - 1. Technical controls * Firewalls * Data Encryption * Network Segmentation * Network monitoring and logging   + - 1. Administrative controls * Access controls * Employee training on security awareness. * Screening and verification * Authentication mechanism   1. Computer network risk assessment reports      1. computer network risk assessment      2. reasons for conducting computer network risk assessment      3. Key components of a computer network risk assessment      4. How to conduct a computer network risk assessment      5. Tools and technologies for computer network risk assessment         1. Planning and preparation:         2. Threat analysis         3. Vulnerability scanners:         4. ‍Risk management software      6. Best practices for network risk assessment      7. Documentation of the risk assessment report | 1. Practical test 2. Project 3. Portfolio of evidence 4. Oral questioning 5. Interviews 6. Third party report 7. Written tests 8. Case study |
| 1. Monitor Computer Network Firewall activities | * 1. Computer Network Firewall      1. Introduction to computer network firewall      2. Importance of computer network firewall      3. Factors to consider in firewall monitoring      4. Types of firewall logs         1. Traffic         2. Event         3. System         4. Threat      5. Tools and techniques used in firewall monitoring         1. Packet filtering         2. Logging and reporting         3. Bandwidth management         4. URL Filtering         5. SolarWinds Network Performance Monitor (NPM)      6. Best practices for firewall management   2. Firewall updates      1. Importance of regular firewall updates      2. procedure to updating firewall firmware and software   3. Computer network traffic.      1. Introduction to computer network traffic monitoring.      2. Benefits of computer network traffic monitoring      3. Monitoring of computer network traffic      4. Computer Network traffic monitoring tools         1. Wireshark         2. SolarWinds Network Performance Monitor (NPM)         3. Cisco Network Assistant (CNA) | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |
| 1. Perform fundamental Computer Network segmentation | * 1. IP addressing scheme.      1. IP addressing and subnetting      2. IP address fundamentals         1. Physical address. MAC address.         2. Logical address. IP address.         3. Hostname.         4. IPv4 vs. IPv6         5. Classful addressing         6. Static vs. Dynamic IP Addressing         7. Public vs. Private IP Addresses      3. Steps in Designing an IP Addressing Scheme   2. Network segmentation      1. Introduction to network segmentation         1. Definition of network segmentation         2. Physical & logical segmentation         3. Importance of network segmentation      2. Types of network segmentation         1. IP based         2. VLANs         3. Subnetting         4. Firewalls         5. Physical segmentation      3. Tools and techniques for network segmentation         1. Firewalls, Routers, and Access Control Lists (ACLs)         2. Network Access Control (NAC)      4. Monitoring and Managing Network Segments   3. Network privileges.      1. Introduction to network privilege management         1. Definition of Network Privileges.         2. Roles of network privileges.      2. Types of Network Privileges:         1. Read, Write, Execute      3. Roles of Privilege Management in Network Security         1. Administrator privileges         2. User privileges         3. Read-only access         4. Remote access privileges      4. implementation of network access control      5. Understand Network Access Requirements      6. Develop Access Control Policies      7. Select a Network Access Control Solution | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| * **Network security Threats & Vulnerabilities** may include but not limited to; | * + Malware   + Phishing   + Man in the middle attack   + Denial of service attack   + SQL injection   + Weak authentication and authorization   + Physical security threats |
| * **Network Security Controls** may include but not limited to; | * + Firewalls   + Network segmentation   + Network monitoring and logging   + Authentication mechanisms |
| * **Firewall activities** may include but not limited to; | * + Packet filtering   + Logging and reporting   + Bandwidth management   + URL Filtering |
| * **IP addressing scheme** may include but not limited to; | * + Classful addressing   + Private IP addressing   + Public IP addressing |
| * **Network segmentation** may include but not limited to; | * + VLANs   + Subnetting   + Firewalls   + Physical segmentation |
| * **Network privileges** may include but not limited to; | * + Administrator privileges   + User privileges   + Read-only access   + Remote access privileges |

**Suggested Methods of delivery**

* Role playing
* Viewing of related videos
* Group discussions.
* Instructor led facilitation using active learning strategies.
* Projects.
* Demonstrations.
* Site visits.

.

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Trainee: Item) |
| **A** | **Learning Materials** | | | |
|  | Textbooks |  | 13 pcs | 2:1 |
|  | Installation manuals |  |  |  |
|  | Flip Charts |  |  |  |
|  | PowerPoint presentations | For trainer’s use |  |  |
| **B** | **Learning Facilities & infrastructure** | | | |
|  | Lecture/theory room |  | 1 | 25:1 |
|  | Laboratory |  | 1 | 25:1 |
| **C** | **Consumable materials** | | | |
|  | Printing papers |  | 1 ream | 1:20 |
|  | Toners/Cartridges |  | 2 pcs | 13:1 |
|  | Assorted colour of whiteboard markers |  |  |  |
| **D** | **Tools and Equipment** | | | |
|  | Computers |  | 25 pcs | 1:1 |
|  | Projector |  | 1 pc | 25:1 |
|  | Flash drives |  | 25 pairs | 1:1 |
|  | External CD/DVD drives |  | 13 pcs | 2:1 |

## BASIC ELECTRONICS

**UNIT CODE**: 0714 441 04A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply Basic Electronics

**Duration of Unit:** 100 Hours

**Unit description**

This unit specifies the competencies required to demonstrate basic skills of electronics. It includes identifying electrical circuits, identifying electronic components, applying semi-conductor theory, classifying computer memory, applying logic gates and performing Boolean algebra operations.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **DURATION (HOURS)** |
| 1. Identify electric circuits | 4 |
| 1. Identify electronic components | 4 |
| 1. Apply semi-conductor theory | 20 |
| 1. Classify computer memory | 20 |
| 1. Apply logic gates | 32 |
| 1. Perform Boolean algebra operations | 20 |
| **TOTAL** | **100** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 1. Identify electrical   circuits | 1. Electrical circuit identification    * 1. Definition of electrical circuit      2. Components of electrical circuit 2. Electrical quantities and their S.I units identification    * 1. Basic electrical quantities and their units         1. Emf in volts         2. Current in Amperes         3. Power in watts         4. Energy in joules         5. Resistance in ohms 3. Types of electrical circuits    * 1. AC – Alternating Current      2. DC – Direct Current | * + Practical exercises   + Written   + Observation   + Oral |
| 1. Identify Electronic components | * 1. Identification of electronic components      1. Resistor      2. Capacitor      3. Diode      4. Inductor   2. Characteristic of electronic components.   3. Application of electronic components.   4. Characteristics of integrated circuit | * + Practical exercises   + Written   + Observation   + Oral |
| 1. Apply semi-conductor theory | * 1. Explanation of semiconductor theory   2. Descriptions of structure of matter   3. Explanation of Electrons in conductors and semiconductors   4. Types of semiconductor materials      1. Silicon      2. Germanium   5. Explanation of P-type and N-type materials   6. Description of P-N junction diodes      1. Forward biasing      2. Reverse biasing   7. Types and operations of transistors      1. PNP type      2. NPN type   8. Application of Semiconductor theory | * + Practical exercises   + Written   + Observation   + Oral |
| 1. Classify computer memory | * 1. Identification of computer memories      1. Definition of computer memory      2. Classification of computer memory         1. Primary memory         2. Secondary memory      3. Types of computer memories         1. RAM         2. ROM         3. DAM   2. Identification of Memory hierarchy speed      1. Registers      2. Cache memory      3. Main memory      4. Secondary storage      5. Tertiary storage   3. Identification of memory storage levels      1. Internal      2. Main      3. Online      4. Offline bulk   4. Classify computer memories as per the technology used      1. Semiconductor memory      2. Magnetic memory      3. Optical memory | * + Practical exercises   + Written   + Observation   + Oral |
| 1. Apply logic gates | * 1. Identification of Logic gates      1. Definition of terms      2. Types of logic gates         1. AND Gate         2. OR Gate         3. NOT Gate         4. NAND Gate         5. NOR Gate         6. XOR Gate         7. XNOR Gate   2. Development of Logic circuits   3. Simplification of Logic circuits      1. Logic circuits Simplification Methods         1. Boolean Algebra         2. K-Maps         3. Quine-McCluskey Algorithm         4. Software and CAD Tools   5.4 Application of logic gates in electronic circuits | * + Practical exercises   + Written   + Observation   + Oral |
| 1. Perform Boolean algebra operations | * 1. Identify key concepts in Boolean algebra      1. Boolean variables      2. Logical operations      3. Boolean expressions      4. Laws and rules of Boolean algebra      5. Truth tables      6. De Morgan’s theorem   2. Demonstration of Boolean expressions   3. Performance of Basic Boolean operations   4. Methods of simplifying Boolean expressions   5. Illustration of Boolean Laws and Theorems   6. Simplification rules for Boolean expressions | * + Practical exercises   + Written   + Observation   + Oral |

**Suggested Delivery Methods**

* Instructor led facilitation using active learning strategies
* Demonstration by trainer
* Practical work by trainee
* Viewing of related videos
* Group discussions
* Direct instructions

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Trainee: Item) |
| **A** | **Learning Materials** | | | |
|  | Textbooks |  | 13 pcs | 2:1 |
|  | Installation manuals |  |  |  |
|  | Flip Charts |  |  |  |
|  | PowerPoint presentations | For trainer’s use |  |  |
| **B** | **Learning Facilities & infrastructure** | | | |
|  | Lecture/theory room |  | 1 | 25:1 |
|  | Laboratory |  | 1 | 25:1 |
| **C** | **Consumable materials** | | | |
|  | Printing papers |  | 1 ream | 1:20 |
|  | Toners/Cartridges |  | 2 pcs | 13:1 |
|  | Assorted colour of whiteboard markers |  |  |  |
| **D** | **Tools and Equipment** | | | |
|  | Computers |  | 25 pcs | 1:1 |
|  | Projector |  | 1 pc | 25:1 |
|  | Signal testers |  | 5 pcs | 5:1 |
|  | Header checker |  | 25 pcs | 1:1 |
|  | Crimping tools |  | 13 pcs | 2:1 |
|  | Cable tester |  | 5 pcs | 5:1 |
|  | Punch Downs |  | 5 pcs | 5:1 |
|  | Switches |  | 5pcs | 5:1 |
|  | Repeaters |  | 5pcs | 5:1 |
|  | Routers/modem |  | 5pcs | 5:1 |
|  | Network tool kit |  | 25 pcs | 1:1 |
|  | Gateways |  | 5pcs | 5:1 |
|  | Packets of RJ45 |  | 300 pcs | 1:10 |
|  | Fibre Modules (SFP) |  | 5pcs | 5:1 |
|  | UTP Ethernet Cable |  | 300 meters | 1:10 |
|  | Antistatic gloves |  | 25 pairs | 1:1 |
|  | Ohmmeter |  |  |  |
|  | Ammeter |  |  |  |
|  | Digital Multi meter |  |  |  |
|  | Power supplies |  |  |  |
|  | Circuits |  |  |  |
|  | Semiconductor materials |  |  |  |
|  | Conductors e.g., copper, gold, silver |  |  |  |
|  | Insulators |  |  |  |
|  | Screw Drivers |  |  |  |
|  | Resistors |  |  |  |
|  | Capacitors |  |  |  |
|  | Logic gates |  |  |  |
|  | Inductors |  |  |  |
|  | Transistors |  |  |  |
|  | Transformers batteries, power supplies |  |  |  |
|  | Conducting wires |  |  |  |

## WORK ETHICS AND PRACTICES

**UNIT CODE**: 0417 451 02A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Apply work ethics and practices.

**Duration of Unit:** 40 hours

**Unit Description**

This unit covers competencies required to demonstrate employability skills. It involves the ability to: conducting self-management, promoting ethical work practices and values, promoting teamwork, managing workplace conflicts, maintaining professional and personal development, applying problem-solving, and promoting customer care.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **DURATION (HOURS)** |
| 1. Apply self-management skills | 10 |
| 1. Promote ethical practices and values | 4 |
| 1. Promote teamwork | 10 |
| 1. Maintain professional and personal development | 10 |
| 1. Apply problem-solving skills | 4 |
| 1. Promote customer care. | 2 |
| **TOTAL** | **40** |

**Learning Outcomes, Content, and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Apply self-management skills | * 1. Self-awareness   2. Formulating personal vision, mission, and goals   3. Healthy lifestyle practices   4. Strategies for overcoming work challenge   5. Emotional intelligence   6. Coping with Work Stress.   7. Assertiveness versus aggressiveness and passiveness   8. Developing and maintaining high self-esteem   9. Developing and maintaining positive self-image   10. Time management   11. Setting performance targets   12. Monitoring and evaluating performance targets | * Observation * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |
| 1. Promote ethical work practices and values | * 1. Integrity   2. Core Values, ethics and beliefs   3. Patriotism   4. Professionalism   5. Organizational codes of conduct   6. Industry policies and procedures | * Observation * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |
| 1. Promote Teamwork | * 1. Types of teams   2. Team building   3. Individual responsibilities in a team   4. Determination of team roles and objectives   5. Team parameters and relationships   6. Benefits of teamwork   7. Qualities of a team player   8. Leading a team   9. Team performance and evaluation   10. Conflicts and conflict resolution   11. Gender and diversity mainstreaming   12. Developing Healthy workplace relationships   13. Adaptability and flexibility   14. Coaching and mentoring skills | * Observation * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |
| 1. Maintain professional and personal development | * 1. Personal vs professional development and growth   2. Avenues for professional growth   3. Recognizing career advancement   4. Training and career opportunities   5. Assessing training needs   6. Mobilizing training resources   7. Licenses and certifications for professional growth and development   8. Pursuing personal and organizational goals   9. Managing work priorities and commitments   10. Dynamism and on-the-job learning | * Observation * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |
| 1. Apply Problem-solving skills | * 1. Causes of problems   2. Methods of solving problems   3. Problem-solving process   4. Decision making   5. Creative thinking and critical thinking process in development of innovative and practical solutions | * Observation * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |
| 1. Promote Customer Care | * 1. Identifying customer needs   2. Qualities of good customer service   3. Customer feedback methods   4. Resolving customer concerns   5. Customer outreach programs   6. Customer retention | * Observation * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |

**Suggested Methods of Instruction**

* Instructor lead facilitation of theory using active learning strategies.
* Demonstrations
* Simulation/Role play
* Group Discussion
* Presentations
* Projects
* Case studies
* Assignments

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  **(Trainee: Item)** |
| **A** | **Learning Materials** |  |  |  |
|  | 1. Textbooks |  | 5 pcs | 5:1 |
|  | 1. PowerPoint presentations | For trainer’s use |  |  |
|  | 1. Assorted colour of whiteboard markers | For trainer’s use | 2 packets |  |
|  | 1. e-Didactics | For trainer’s use |  |  |
|  | 1. Flashcards |  |  |  |
|  | 1. Flip charts |  |  |  |
|  | 1. Whiteboard |  |  |  |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | 1. Lecture/theory room |  | 1 | 25:1 |
| **C** | **Consumable materials** |  |  |  |
|  | 1. Printing Papers |  | 1 ream | 1:20 |
|  | 1. Toners |  | 2 pcs | 13:1 |
|  | 1. Internet connection |  |  |  |
| **D** | **Tools and Equipment** |  |  |  |
|  | 1. Projectors |  | 1 | 25:1 |
|  | 1. Printers |  | 4 | 6:1 |
|  | 1. Computers/Mobile Phones |  | 25 pcs | 1:1 |

# MODULE 5

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UNIT**  **CATEGORY** | **UNIT CODE** | **UNIT NAME** | **DURATION**  **(Hours)** | **CREDIT FACTORS** |
| **COMMON** | 0541 551 03A | Discrete Mathematical Concepts | 160 | 16.0 |
| **CORE** | 0612 551 04A | Computer System Administration | 220 | 22.0 |
| **BASIC** | 0031 551 01A | Communication Skills | 40 | 4.0 |
|  |  | **Total** | **420** | **42.0** |

**DISCRETE MATHEMATICAL CONCEPTS**

**UNIT CODE:** 0541 551 03A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Apply Discrete Mathematical Concepts

**Duration of Unit:** 160 Hours

**Unit Description**

This unit covers the competence to apply discrete mathematical concepts. It involves carrying out set theory operations, performing matrix operations, applying number systems, applying logic gates, performing sequence and series operations and demonstrating graph theory.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **DURATION (HOURS)** |
| 1. Carry out set theory operations | 32 |
| 1. Perform matrix operations | 26 |
| 1. Apply number system | 26 |
| 1. Apply logic gates | 30 |
| 1. Perform sequence and series operations | 20 |
| 1. Demonstrate graph theory | 26 |
| **TOTAL** | **160** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| * + - 1. Carry out set theory operations | * 1. Identify sets Characteristics      1. Definition      2. Order and Uniqueness   2. Methods of set representation      1. Roster Form      2. Set Builder Form   3. Cardinality of a set.      1. Finite      2. Infinite   4. Types of sets      1. Finite set      2. Infinite set      3. Empty set      4. Subset      5. Universal set   5. Venn Diagrams      1. Drawing Venn diagrams   6. Set Operations      1. Union      2. Intersection      3. Difference      4. Complement | * Practical Activities * Project work * Demonstration * Group Work * Observation * Portfolio of Evidence * Written tests |
| * + - 1. Perform matrix operations | * 1. Applying Matrix order      1. Dimension of matrix      2. Types of Matrices         1. Row matrix         2. Column matrix         3. Square matrix         4. Zero matrix   2. Matrix operations      1. Addition      2. Multiplication      3. Subtraction   3. Transpose of a matrix      1. Swapping rows and columns   4. Transpose operations      1. Transpose      2. Sum      3. Product   5. Adjoint of a square matrix identification   6. Inverse of a square matrix identification.      1. Trace of a matrix application      2. Application of matrices      3. Computer Graphics      4. Statistics      5. Systems of Linear Equations | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |
| * + - 1. Apply number Systems | * 1. Number systems      1. Definition of terms      2. Absolute values      3. Place values      4. Types of number systems         1. Decimal         2. Binary         3. Octal         4. Hexadecimal   2. Base conversion      1. Decimal to Other number system      2. Other number systems to decimal      3. Binary to other number systems      4. Other number systems to binary   3. Number systems arithmetic operations      1. Binary arithmetic         1. Addition, subtraction, multiplication and division         2. Ones and Twos complement      2. Octal arithmetic         1. Addition and subtraction      3. Hexadecimal arithmetic         1. Addition and subtraction   4. Binary codes      1. Binary coded decimal (BCD)         1. BCD operations         2. Addition and subtraction      2. ASCII      3. Gray Code      4. Excess-3 | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |
| * + - 1. Apply logic gates | * 1. Types of Logic gates      1. AND      2. OR      3. NOT      4. NAND      5. NOR      6. XOR      7. XNOR   2. Logic expressions      1. Logic circuit diagrams      2. Truth tables   3. Simplifying logic expressions      1. De-Morgan's theorems      2. Laws of Boolean algebra         1. Commutative         2. Associative         3. Distributive and more         4. Identity laws         5. Null laws         6. Complement laws         7. Commutative laws      3. Boolean expressions simplification.      4. Application of Boolean Algebra.      5. Application of Karnaugh’s Maps | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |
| * + - 1. Perform sequence and series operations | * 1. Key terms of sequences.      1. Term      2. Index      3. General term (nth term)      4. Finite sequence      5. Infinite sequence   2. Summation of a sequence.      1. Arithmetic sum   3. Arithmetic series      1. General form of an arithmetic sequence      2. Sum of the first n terms   4. Geometric series      1. General form of a geometric sequence | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |
| * + - 1. Demonstrate graph theory | * 1. Key Graph terminologies      1. Node      2. Edge      3. Vertex      4. Adjacent   2. Types of graphs      1. Null      2. Simple      3. Multigraph      4. Directed graphs      5. Undirected graphs   3. Representation of graphs      1. Adjacency Matrix      2. Adjacency List      3. Incidence Matrix   4. Application of graphs      1. Computer Networks      2. Social Networks      3. Transport Networks      4. Scheduling and Task Management | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |

**Suggested Delivery Methods**

* + Instructor led facilitation using active learning strategies
  + Demonstration by trainer
  + Practical work by trainees
  + Viewing of related videos
  + Field Visits
  + Group Work
  + Role plays
  + Group projects

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** |  |  |  |
|  | Internet connection | * + 5mbps | 1 | 1:1 |
|  | Flip charts | A1 | 1 | 1:25 |
|  | Textbooks | For reference | 3 | 3:25 |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Theory Room | furnished with 25 Arm-chairs and a suitable trainer’s table | 1 | 1:25 |
| **C** | **Consumable materials** |  |  |  |
|  | Printing papers | A4 | 5 Reams | 1:25 |
|  | White board markers | Assorted colors | 20 | 4:5 |
| **D** | **Tools and Equipment** |  |  |  |
|  | External storage media | HDD / SSD / Flash | 1 | 1:25 |
|  | Printer | Working printer | 2 | 1:12 |
|  | 1 Smart-board / Smart TV / Projector (with screen) | Where available | 1 | 1:25 |
|  | Whiteboard/Chalkboard | 4 X 8 Feet | 1 | 1:25 |

## COMPUTER SYSTEM ADMINISTRATION

**UNIT CODE:** 0612 551 04A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Perform Computer System Administration

**Unit Duration:** 220 Hours

**Unit Description**

This unit covers the competencies required to perform computer system administration. It involves managing computer systems, configuring computer hardware and software and upgrading computer systems.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **Learning Outcomes** | **Duration (Hours)** |
| 1. Manage Computer systems | 120 |
| 1. Configure Computer hardware and software | 120 |
| 1. Upgrade Computer systems | 60 |
| **TOTAL** | **220** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Manage Computer systems   . | * 1. Computer systems incident response      1. Introduction to computer systems incident response management      2. Types of incident response reports * Initial incident report * Post incident review report * Detailed incident analysis report   + 1. Computer systems incident management life cycle * Incident identification. * Incident categorization. * Incident prioritization. * Incident response. * Incident closure.   1. Computer system documentation and reporting compilation.      1. Meaning and importance of computer system documentation and reporting      2. Types of computer system documentation * System documentation * Technical documentation * Installation guide documentation * User documentation * Maintenance documentation   + 1. Types of computer system reporting * System performance report * Error and event report * Security reports * Audit and compliance report * Backup and recovery report   1. system user management      1. Importance of system user management      2. Types of system user accounts * Administrator * Guest * Service * Standard   + 1. Creating and managing system user accounts     2. Authentication and authorization * Authentication methods(passwords, biometrics, Multi-Factor Authentication, Single Sign-On) * Implementing authorization controls   + 1. User permissions and access control   1. Computer system resource allocation      1. Introduction to computer system resource allocation      2. Types of computer System resource * Central Processing Unit * Computer Memory * Motherboard * Device Drivers * Computer Storage * Computer I/O devices * Graphic Processing Unit * Network bandwidth   + 1. Factors to consider when allocating computer system resources * Type of resource * Task requirement * System performance and utilization * Scalability * Security and isolation   + 1. Techniques and concepts of computer system resource allocation * Process scheduling * Swapping * load balancing * disk partitioning   + 1. Computer system resource allocation environment * Cloud computing * Virtualization   + 1. Strategies for effective resource allocation * Quality of service * Dynamic resource * Power management   1. Computer system disaster recovery plan      1. Introduction to computer system disaster recovery plan      2. Type of computer systems disasters * Natural disasters * Cyber security incident * Human error and system failure   + 1. Risk assessment process for computer systems * Identification of potential risks * Evaluation of potential risks * Risk prioritization * Mitigation strategies   + 1. Computer system backup strategies   1. Computer system policy enforcement approaches. * Role-based access control * Automatic enforcement * Mediation/monitoring * Asymmetry | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |
| 1. Configure Computer hardware and software | * 1. Computer hardware and software configuration      1. Introduction to Computer hardware and software configuration * Basic concepts and terminologies * Importance of proper configuration * Overview of hardware and software configuration   + 1. Understanding Systems requirements     2. Importance of system requirements     3. Types of system requirements * Hardware requirement * Software requirement * connectivity requirement   + 1. Determining system requirements   1. Tools and workspace Preparation      1. Proper user of tools      2. Hardware tools * ESD tools * Hand tools * Cleaning tools * Diagnostic tools * Cable tester * Crimping tool * Stripper * Fiber Splicer   + 1. Software tools * Disk management tools * Protection software tools * Diagnostic software tools   + 1. Organizational tools     2. Reference tools * Personal reference tool * Internet reference tool * Standard and procedures   1. Software installation and configuration * Operating software installation and setup * Installing and configuring drivers * Setting up virtual machine (Virtual|Box or VMware) * Managing and optimizing virtual environments * Application software installation * Managing software updates and patches   + 1. Hardware configuration * Identifying hardware components * Setting up and installing hardware * BIOS/UEFI configuration * Configuring hard drives and SSDs * Setting up RAID arrays and storage pool * Managing partitions and file systems * Hardware troubleshooting techniques   1. System functionality testing      1. Introduction to Network      2. Testing Methodologies      3. Performance Metrics      4. Troubleshooting and Debugging      5. Security Testing      6. Documentation and Reporting   2. Introduction to data migration      1. Data migration strategies * Bing bang * Phased data migration strategies   + 1. Planning for data migration     2. Challenges to data migration     3. Data migration tools and techniques     4. Data security compliance during migration   1. Systems backup and recovery      1. Developing a backup strategy      2. Configuring backup software and hardware      3. Testing and verifying backups      4. Recovery planning | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |
| 1. Upgrade Computer systems | * 1. computer system updates and upgrades      1. Introduction to computer system updates and upgrades      2. Types of software upgrades and updates * Functionality expansions upgrades * System integration upgrades * Security features upgrade * Software version upgrade   1. Categories of Computer systems for update and upgrade      1. Types of hardware upgrades and updates * RAM upgrades * Storage upgrades * Processor upgrades * motherboard upgrades * NIC upgrades   1. Performing computer system updates and upgrades      1. Computer system hardware and software updates and upgrades process      2. Maintaining upgrades and updates documentation   2. Creating and updating upgrades and updates reports      1. Best practices for documentation | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study * Written tests * Case study |

**Suggested Methods of delivery**

* Role playing
* Viewing of related videos
* Group discussions.
* Instructor led facilitation using active learning strategies.
* Projects.
* Demonstrations.
* Site visits.

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**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Trainee: Item) |
| **A** | **Learning Materials** | | | |
|  | Textbooks |  | 13 pcs | 2:1 |
|  | Installation manuals |  |  |  |
|  | Flip Charts |  |  |  |
|  | PowerPoint presentations | For trainer’s use |  |  |
| **B** | **Learning Facilities & infrastructure** | | | |
|  | Lecture/theory room |  | 1 | 25:1 |
|  | Laboratory |  | 1 | 25:1 |
| **C** | **Consumable materials** | | | |
|  | Printing papers |  | 1 ream | 1:20 |
|  | Toners/Cartridges |  | 2 pcs | 13:1 |
|  | Assorted colour of whiteboard markers |  |  |  |
| **D** | **Tools and Equipment** | | | |
|  | Computers |  | 25 pcs | 1:1 |
|  | Projector |  | 1 pc | 25:1 |
|  | Flash drives |  | 25 pairs | 1:1 |
|  | External CD/DVD drives |  | 13 pcs | 2:1 |

## COMMUNICATION SKILLS

**UNIT CODE:** 0031 551 01A

**Duration of Unit:** 40 hours

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Apply Communication Skills

**Unit Description**

This unit covers the competencies required to apply communication skills. It involves applying communication channels, written, non-verbal, oral, and group communication skills.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **DURATION (HOURS)** |
| 1. Apply communication channels. | 10 |
| 1. Apply written communication skills. | 12 |
| 1. Apply non-verbal skills. | 4 |
| 1. Apply oral communication skills. | 4 |
| 1. Apply group communication skills. | 10 |
| **TOTAL** | **40** |

**Learning Outcomes, Content, and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Apply communication channels | * 1. Communication process      1. Principles of effective communication   2. Channels/medium/modes of communication      1. Factors to consider when selecting a channel of communication      2. Barriers to effective communication   3. Flow/patterns of communication      1. Sources of information      2. Organizational policies | * Oral questions * Written assessment * Observation * Portfolio of Evidence * Practical assessment * Third party report |
| 1. Apply written communication skills | * 1. Types of written communication   2. Elements of communication   3. Organization requirements for written communication | * Oral assessment * Written assessment * Observation * Portfolio of Evidence * Practical assessment * Third party report |
| 1. Apply non-verbal communication skills | * 1. Utilize body language and gestures   2. Apply body posture   3. Apply workplace dressing code | * Oral assessment * Written assessment * Observation * Portfolio of Evidence * Practical assessment * Third party report |
| 1. Apply oral communication skills | * 1. Types of oral communication pathways   2. Effective questioning techniques   3. Workplace etiquette   4. Active listening | * Oral assessment * Written assessment * Observation * Portfolio of Evidence * Practical assessment * Third party report |
| 1. Apply group discussion skills | * 1. Establishing rapport   2. Facilitating resolution of issues   3. Developing action plans   4. Group organization techniques   5. Turn-taking techniques   6. Conflict resolution techniques   7. Team-work | * Oral assessment * Written assessment * Observation * Portfolio of Evidence * Practical assessment |

**Suggested Methods of Instruction**

* Roleplaying
* Simulation
* Field trips
* Viewing of related videos
* Demonstrations
* Online Training
* Group discussions.
* Instructor led facilitation using active learning strategies.

**Recommended Resources for 25 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  **(Trainee: Item)** |
| A | Learning Materials |  |  |  |
|  | Textbooks |  | 5 pcs | 5:1 |
|  | PowerPoint presentations | For trainer’s use |  |  |
|  | Assorted colour of whiteboard markers | For trainer’s use | 2 packets |  |
|  | e-Didactics | For trainer’s use |  |  |
|  | Flashcards |  |  |  |
|  | Flip charts |  |  |  |
|  | Whiteboard |  |  |  |
| B | Learning Facilities & infrastructure |  |  |  |
|  | Lecture/theory room |  | 1 | 25:1 |
| C | Consumable materials |  |  |  |
|  | Printing Papers |  | 1 ream | 1:20 |
|  | Toners |  | 2 pcs | 13:1 |
|  | Internet |  |  |  |
| D | Tools and Equipment |  |  |  |
|  | Projectors |  | 1 | 25:1 |
|  | Printers |  | 4 | 6:1 |
|  | Computers/Smartphones |  | 25 pcs | 1:1 |

# MODULE 6

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **UNIT**  **CATEGORY** | **UNIT CODE** | **UNIT NAME** | **DURATION**  **(Hours)** | **CREDIT FACTORS** |
| **CORE** | 0612 551 05A | Database Administration | 220 | 22.0 |
| **CORE** | 0612 551 06A | System Virtualization | 220 | 22.0 |
| **BASIC** | 0732 551 02A | Entrepreneurial Skills | 40 | 4.0 |
|  |  | **Total** | **480** | **48.0** |

## DATABASE ADMINISTRATION

**UNIT CODE:** 0612 551 05A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Perform Database Administration

**Unit Duration:** 220 Hours

**Unit Description**

This unit covers the competencies required to Perform Database Administration. It involves installing database, designing database and backing up database.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **DURATION (HOURS)** |
| 1. Install Database | 30 |
| 1. Design Database | 160 |
| 1. Backup Database | 30 |
| **TOTAL** | **220** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Install Database   . | * 1. Database software installation and configuration      1. Introduction to database software installation and configuration      2. Meaning of database software installation and configuration      3. Advantages of database software      4. Application of database software      5. Types of database software         1. Access         2. SQL         3. MySQL         4. Oracle         5. PostgreSQL         6. MongoDB         7. Redis         8. MariaDB      6. Database software installation process      7. database software configuration process      8. best practices in database configuration   2. Database resource allocation      1. Introduction to database systems      2. Database system resource allocation         1. CPU allocation         2. Memory allocation         3. Disk storage allocation         4. Network bandwidth allocation   3. Performing database testing      1. Introduction to database testing         1. Microsoft SQL Server         2. DTM Data generator         3. HammerDB      2. Types of database testing         1. Functional         2. Data integrity         3. Performance         4. Stress and load         5. security      3. Database testing techniques         1. White-box         2. Black-box         3. Query         4. Data validation      4. Database testing tools         1. Apache Jmeter         2. DBFit         3. SQLTest   4. Database storage mechanism      1. Understanding storage architecture      2. Database Indexing      3. Partitioning and shading      4. Database retrieval and performance optimization         1. Creating database queries         2. Query optimization techniques         3. Indexing strategies for efficient retrieval         4. Caching mechanisms   5. Database performance monitoring and optimization      1. Setting up and configuring database monitoring tools (Solarwinds, PRTG, Nagios, NewRelic)   6. Data Migration      1. Collecting and visualizing performance data   7. Database installation Troubleshooting | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |
| 1. Design Database | * 1. Database Structure      1. Introduction to database structures      2. Data modelling concepts         1. Conceptualization         2. Entity-Relationship (ER) diagrams         3. Normalization and Demoralization      3. Database approaches         1. Flat table schema         2. Normalized schema         3. Star schema         4. Hierarchical schema         5. Document database schema   2. Database security      1. Fundamental principles of database security         1. Confidentiality         2. Integrity         3. Availability         4. Accessibility         5. Reliability      2. Implementing database security measures         1. User authentication and access control         2. Encryption         3. Password         4. Database auditing and monitoring         5. Software updates and patching         6. Database backup and recovery.   3. Database storage      1. Meaning database storage      2. Types of database storage         1. Internal         2. external      3. Storage optimization strategies         1. RAID      4. I/O considerations | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |
| 1. Backup Database | * 1. Database Backup      1. Types of database backup         1. Full backup         2. Incremental backup         3. Differential backup      2. Backup location and storage      3. Backup scheduling         1. Automated backups         2. Time window considerations      4. Backup tools         1. Native database tools         2. Third party tools   2. Backup storage and management      1. Backup storage strategy      2. Backup policy      3. Database storage best practices         1. Use compression         2. Database Storage monitoring and maintenance   3. Database Backup security      1. Testing backup and restore processes      2. Disaster recovery and redundancy      3. Database storage setup requirement      4. Data redundancy and replication | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study * Written tests * Case study |

**Suggested Methods of delivery**

* Role playing
* Viewing of related videos
* Group discussions.
* Instructor led facilitation using active learning strategies.
* Projects.
* Demonstrations.
* Site visits.

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Trainee: Item) |
| **A** | **Learning Materials** | | | |
|  | Textbooks |  | 13 pcs | 2:1 |
|  | Installation manuals |  |  |  |
|  | Flip Charts |  |  |  |
|  | PowerPoint presentations | For trainer’s use |  |  |
| **B** | **Learning Facilities & infrastructure** | | | |
|  | Lecture/theory room |  | 1 | 25:1 |
|  | Laboratory |  | 1 | 25:1 |
| **C** | **Consumable materials** | | | |
|  | Printing papers |  | 1 ream | 1:20 |
|  | Toners/Cartridges |  | 2 pcs | 13:1 |
|  | Assorted colour of whiteboard markers |  |  |  |
| **D** | **Tools and Equipment** | | | |
|  | Computers |  | 25 pcs | 1:1 |
|  | Projector |  | 1 pc | 25:1 |
|  | Flash drives |  | 25 pairs | 1:1 |
|  | External CD/DVD drives |  | 13 pcs | 2:1 |

## SYSTEM VIRTUALIZATION

**UNIT CODE:** 0612 551 06A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Perform System Virtualization

**Unit Duration:** 220 Hours

**Unit Description**

This unit covers the competencies required to perform system virtualization. It involves setting up software based virtualization, setting up virtual machines, allocating virtual resources, installing virtual machine operating systems and managing virtual storage.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **DURATION (HOURS)** |
| 1. Setup Software-Based Virtualization | 45 |
| 1. Setup virtual Machines | 25 |
| 1. Allocate Virtual Resources | 25 |
| 1. Install Virtual machine operating systems | 45 |
| 1. Manage Virtual Storage | 80 |
| **TOTAL** | **220** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Set up Software Based Virtualization. | * 1. Virtual System Machine Monitor      1. Introduction to software Based Virtualization      2. benefits of virtualization      3. Types of virtualization         1. Hardware         2. Software         3. network and storage      4. Types of hypervisors         1. Virtualbox         2. VMware         3. Proxmox         4. Openvx         5. Type 1: bare-metal         6. Type 2: hosted      5. Setting up hypervisors   2. Software containerization      1. Definition of containerization      2. Benefits of containerization         1. Portability         2. Scalability         3. Fault torelance         4. Agility      3. Application areas of containerization         1. Cloud migration         2. IoT devices         3. Adoption of micro-service architecture      4. Types of container technology         1. Kubernetes         2. Docker         3. Docker swarm         4. Apache mesos         5. Linux   3. Virtual Machine Setup (VMs)      1. Creating and managing virtual machines      2. Allocating resources (CPU, memory, storage and network) to VMs      3. VM migration      4. Backup and restoration of VM      5. Configuring Virtual networks      6. Security consideration for hypervisors and VMs | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |
| 1. Setup virtual Machines | * 1. Virtual Machines Configuration      1. Installing and configuring type 1 and type 2 hypervisors      2. Creating virtual machines      3. Introduction to Docker platform   2. Virtual Machine resource allocation   3. Dockers configuration      1. Setting up and configuring Docker      2. Introduction to container orchestration | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |
| 1. Allocate Virtual resources | * 1. Virtual Machine Resources      1. Key concepts      2. Types of Virtual Machine Resources         1. RAM         2. Storage space   2. Docker Images      1. introduction and importance of Docker images      2. Components of Docker images         1. Layers         2. Base image         3. Dockerfile         4. Image ID         5. tags      3. Container orchestration tools   3. Docker Commands      1. Introduction to Docker Commands      2. Docker image sub commands         1. Docker build         2. Docker pull         3. Docker rm         4. Docker commit      3. Docker image structure      4. Creation of docker image | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study * Written tests * Case study |
| 1. Install Virtual machine Operating systems | * 1. Virtual Machine – Operating System      1. Introduction to Virtual machine operating systems      2. Types of virtual machine operating system         1. Windows         2. Linux         3. MAC      3. Installation of virtual machine operating system process   2. Virtual Machine Parameters      1. Introduction to virtual machine parameters specifications      2. Virtual machines configuration parameters         1. Name and folder         2. Host /cluster         3. Resource pool         4. Data store         5. Hardware machine version         6. Guest operating system         7. Memory         8. CPUs         9. Network   3. Virtual Network Configuration      1. Introduction to Virtual network configuration      2. Components of virtual networking         1. Virtual network Interface Card         2. Virtual switch         3. Virtual router         4. Virtual segmentation      3. Types of virtual networking         1. Host Only Network         2. Network address translation Network         3. Internal network         4. Bridged Network      4. Virtual networking in cloud environment         1. AWS         2. Vnet         3. Azure         4. Google cloud      5. Benefits of virtual networking      6. Challenges of virtual networking | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |
| 1. Manage virtual Storage | * 1. Introduction to virtual storage      1. Types of virtual storage         1. Block storage         2. Software define storage(SDS)      2. Storage virtualisation techniques         1. Host based         2. Array based         3. Network based   2. Virtual Disks      1. Introduction to virtual disk      2. Types of virtual disks         1. Thick Provisioning         2. Thin provisioning      3. Virtual disk management techniques         1. Resize virtual disks         2. Snapshots and storage         3. Storage allocation strategies         4. Disk defragmentation      4. Storage technologies in virtual environments         1. Storage area networks         2. Network attached storage         3. Software defined storage      5. Backup and disaster recovery for virtual disks         1. Regular backups         2. Disaster recovery      6. Storage best practices for virtual disks         1. Regular monitoring         2. Optimize storage tools   3. Cloud Storage Configuration      1. Introduction to cloud storage configuration for remote access      2. Types of cloud storage configurations      3. Setting up remote access to cloud storage      4. Access control and authentication      5. Configuring cloud storage for file sharing      6. Using virtual private networks for cloud storage access      7. Configuring cloud storage access for remote access         1. Remote desktop solutions         2. Mobile device access         3. Remote video and media access      8. Compliance and data governance for remote access to cloud storage      9. Monitoring and auditing remote access to cloud storage | * Practical test * Project * Portfolio of evidence * Oral questioning * Interviews * Third party report * Written tests * Case study |

**Suggested Methods of delivery**

* Role playing
* Viewing of related videos
* Group discussions.
* Instructor led facilitation using active learning strategies.
* Projects.
* Demonstrations.
* Site visits.

.

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Trainee: Item) |
| **A** | **Learning Materials** | | | |
|  | Textbooks |  | 13 pcs | 2:1 |
|  | Installation manuals |  |  |  |
|  | Flip Charts |  |  |  |
|  | PowerPoint presentations | For trainer’s use |  |  |
| **B** | **Learning Facilities & infrastructure** | | | |
|  | Lecture/theory room |  | 1 | 25:1 |
|  | Laboratory |  | 1 | 25:1 |
| **C** | **Consumable materials** | | | |
|  | Printing papers |  | 1 ream | 1:20 |
|  | Toners/Cartridges |  | 2 pcs | 13:1 |
|  | Assorted colour of whiteboard markers |  |  |  |
| **D** | **Tools and Equipment** | | | |
|  | Computers |  | 25 pcs | 1:1 |
|  | Projector |  | 1 pc | 25:1 |
|  | Flash drives |  | 25 pairs | 1:1 |
|  | External CD/DVD drives |  | 13 pcs | 2:1 |

## ENTREPRENEURIAL SKILLS

**UNIT CODE:**  0413 541 16A

**Relationship to occupational standards**

This unit addresses the unit of competency: Apply Entrepreneurial skills.

**Duration of unit:** 60 hours

**Unit Description:**

This unit covers the competencies required to demonstrate an understanding of entrepreneurship. It involves demonstrating an understanding of financial literacy, applying entrepreneurial concepts identifying entrepreneurship opportunities, applying business legal aspects, and developing business innovative strategies and business plans.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **LEARNING OUTCOMES** | **DURATION (HOURS)** |
| 1. Apply financial literacy | 6 |
| 1. Apply the entrepreneurial concept | 4 |
| 1. Identify entrepreneurship opportunities | 6 |
| 1. Apply business legal aspects | 6 |
| 1. Innovate Business Strategies | 6 |
| 1. Develop business plan | 12 |
| **TOTAL** | **40** |

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Apply financial literacy | * 1. Personal finance management   2. Balancing between needs and wants   3. Budget Preparation   4. Saving management   5. Factors to consider when deciding where to save   6. Debt management   7. Factors to consider before taking a loan   8. Investment decisions   9. Types of investments   10. Factors to consider when investing money   11. Insurance services   12. insurance products available in the market   13. Insurable risks | * Observation * Project * Written assessment * Oral assessment * Third party report * Interviews |
| 2.Apply entrepreneurial concept | * 1. Difference between Entrepreneurs and Business persons   2. Types of entrepreneurs   3. Ways of becoming an entrepreneur   4. Characteristics of Entrepreneurs   5. salaried employment and self-employment   6. Requirements for entry into self-employment   7. Roles of an Entrepreneur in an enterprise   8. Contributions of Entrepreneurship | * Observation * Project * Written assessment * Oral assessment * Third party report |
| 3.Identify entrepreneurship opportunities | * 1. Sources of business ideas   2. Factors to consider when evaluating business opportunity   3. Business life cycle | * Observation * Project * Written assessment * Oral assessment * Third party report |
| 4.Apply business legal aspects | * 1. Forms of business ownership   2. Business registration and licensing processing   3. Types of contracts and agreements   4. Employment laws   5. Taxation laws | * Observation * Project * Written assessment * Oral assessment * Third party report |
| 5.Innovate business Strategies | * 1. Creativity in business   2. Innovative business strategies   3. Entrepreneurial Linkages   4. ICT in business growth and development | * Observation * Project * Written assessment * Oral assessment * Third party report |
| 6.Develop Business Plan | * 1. Business description   2. Marketing plan   3. Organizational/Management   plan   * 1. Production/operation plan   2. Financial plan   3. Executive summary   4. Business plan presentation   5. Business idea incubation | * Observation * Written assessment * Project * Oral assessment * Third party report |

**Suggested Methods of Instruction**

* Direct instruction with active learning strategies
* Project (Business plan)
* Case studies
* Field trips
* Group Discussions
* Demonstration
* Question and answer
* Problem solving
* Experiential
* Team training
* Guest speakers

**Recommended Resources for 25 Trainees**

* 5 Case studies
* 5 Business plan templates
* 10 Computers
* 1 Overhead projectors
* Internet
* Video clips
* 5 Newspapers and Handouts
* 5 Business Journals
* 25 sets of Writing materials