REPUBLIC OF KENYA

COMPETENCY BASED MODULAR CURRICULUM

FOR

NETWORK SYSTEM ADMINISTRATION

KNQF LEVEL 6

CYCLE 3

PROGRAMME CODE: 0612 554A

TVET CDACC

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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

TVET CDACC

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

TVET CDACC

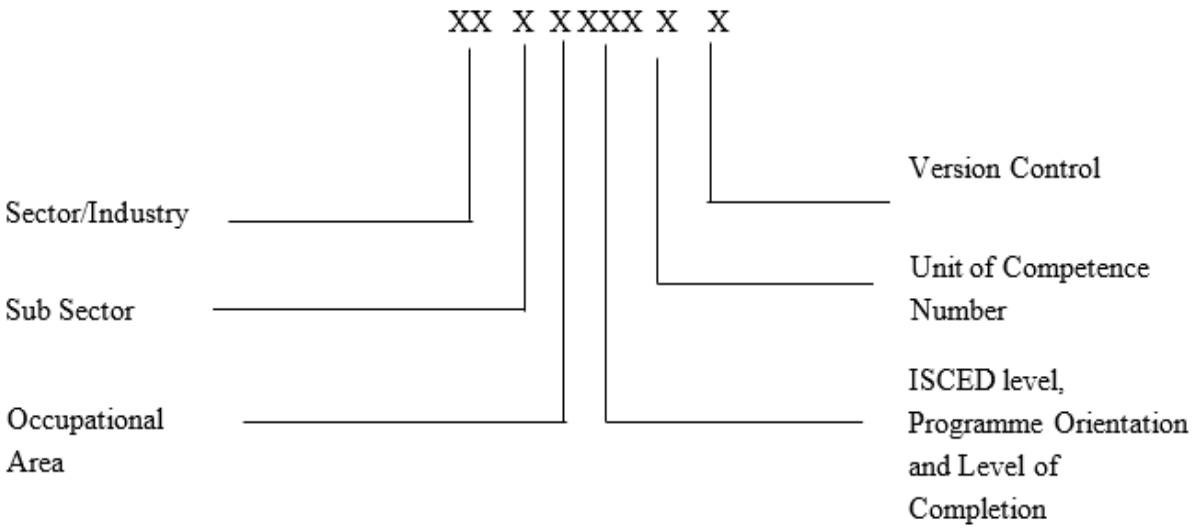
TABLE OF CONTENTS

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
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
VLAN	Virtual Local Area Network
WAN	Wide Area Network

KEY TO UNIT CODE



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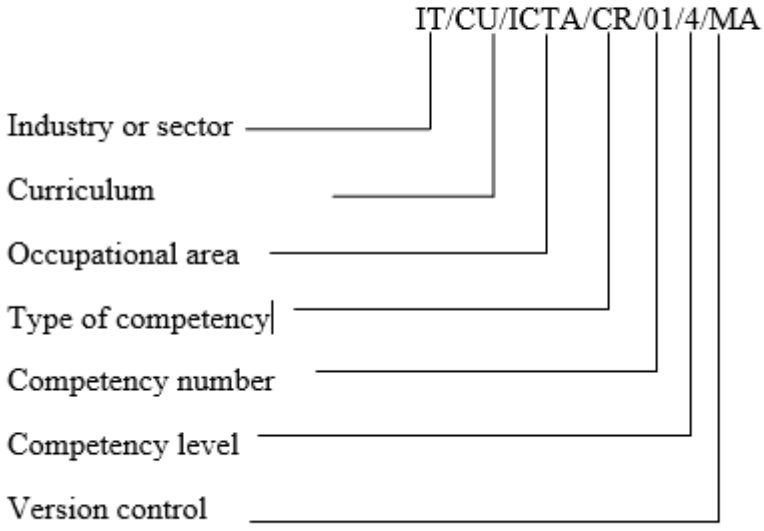

COURSE OVERVIEW

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

UNIT CATEGORY	ISCED UNIT CODE	TVET CDACC UNIT COI	UNIT NAME	DURATION (Hours)	CREDIT FACTOR
MODULE I					
COMMON	0611 541 01A	IT/CU/NSA/CC/01/5/MA	Computer Operations	90	9.0
CORE	0612 551 02A	IT/CU/NSA/CR/01/5/MA	Computer Network Design	200	20.0
COMMON	0714 551 03A	IT/CU/NSA/CC/02/5/MA	Computer Repair and Maintenance	130	13.0
Total				**420**	**42.0**

MODULE II					
CORE	0612 551 04A	IT/CU/NSA/CR/02/5/MA	Computer Network Setup	200	20.0
CORE	0612 551 05A	IT/CU/NSA/CR/03/5/MA	Computer Network Software Installation	200	20.0
Total				**400**	**40.0**
MODULE III					
CORE	0612 551 06A	IT/CU/NSA/CR/04/5/MA	Computer Network Security Configuration	210	21.0
CORE	0612 451 07A	IT/CU/NSA/CR/05/5/MA	Computer Network Maintenance	210	21.0
			Total	**420**	**42.0**
MODULE IV					
CORE	0612 551 08A	IT/CU/NSA/CR/06/5/MA	Computer Network Security Monitoring	220	22.0
COMMON	0714 541 09A	IT/CU/NSA/CC/03/5/MA	Basic Electronics	100	10.0
BASIC	0417 551 10A	IT/CU/NSA/BC/01/5/MA	Work Ethics and Practices	40	4.0
			Total	**360**	**36.0**
MODULE V					
COMMON	0541 551 11A	IT/CU/NSA/CC/01/6/MA	Discrete Mathematical Concepts	160	16.0

CORE	0612 551 12A	IT/CU/NSA/CR/01/6/MA	Computer System Administration	220	22.0
BASIC	0031 551 13A	IT/CU/NSA/BC/01/6/MA	Communication Skills	40	4.0
			Total	**420**	**42.0**
MODULE VI					
CORE	0732 551 14A	IT/CU/NSA/CR/02/6/MA	Database Administration	220	22.0
CORE	0732 551 15A	IT/CU/NSA/CR/03/6/MA	System Virtualization	220	22.0
BASIC	0732 551 16A	IT/CU/NSA/BC/02/6/MA	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:

a) Kenya Certificate of Secondary Education (KCSE) mean grade C-(minus)

Or

b) Certificate in Network Administration or related course level 5

Or

c) Equivalent qualification as determined by TVETA

Trainer Qualification

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

a) Have a minimum of Level 7 qualification in Network Administration or trade area related to this course.

b) 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:

a) During formative assessment all performance criteria shall be assessed based on performance criteria weighting.
b) Number of formative assessments shall minimally be equal to the number of elements in a unit of competency.
c) During summative assessment basic and common units may be integrated in the core units or assessed as discrete units.
d) Theoretical and practical weighting for each unit of learning shall be as follows;
    i. 30:70 for units in modules I, II, III and IV.
    ii. 40:60 for units in module V and VI
e) 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:

    i) Obtained at least 40% in theory assessment in formative and summative assessments.
    ii) Obtained at least 60% in practical assessment in formative and summative assessment where applicable.
    iii) 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.

f) 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

g) 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 Administration 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 541 01A	Computer Operations	90
CORE	0612 551 02A	Computer Network Design	200
COMMON	0714 551 03A	Computer Repair and Maintenance	130
		Total	**420**

COMPUTER OPERATIONS

UNIT CODE: 0611 541 01A
Duration of Unit: 90 hours

Relationship to Occupational Standards

This unit addresses the Unit of Competency: Apply Computer Operations

Unit Description

This unit covers the competencies required to apply computer operations. It involves processing computerized word documents, manipulating computerized spread sheets, maintaining computerized databases, prepare PowerPoint presentation, manipulating graphic application and performing online collaboration.

Summary of Learning Outcomes

Learning Outcomes	Durations (Hours)
1. Process computerized word document	20
2. Manipulate computerized spreadsheet	25
3. Maintain computerized database	15
4. Prepare Power point presentation	10
5. Manipulate graphic application	10
6. Perform online collaboration	10
TOTAL	**90**

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Process computerized word document	1.1 Ergonomic risk factors 1.2 Operating Computer devices 1.2.1 Meaning and importance of computer 1.2.2 Functions and Uses of Computers 1.2.3 Classification of computers 1.2.4 Components of a computer	● Practical assessment ● Simulations ● Project ● Observation Checklist ● Product Checklist ● Written assessment ● Portfolio of evidence

	system 1.2.5 Computer Hardware 1.2.5.1 The System Unit 1.2.5.2 Input Devices 1.2.5.2.1 Mouse use techniques 1.2.5.2.2 Keyboard Parts and Use Techniques 1.2.5.3 Output Devices 1.2.5.4 Storage Devices 1.2.5.5 Computer Ports 1.2.6 Procedure for turning/off a computer 1.2.7 Desktop Customization 1.2.8 File and Files Management using an operating system 1.2.9 Computer external devices management 1.3 Creation of computerized word document 1.3.1 Introduction to word document 1.3.2 Types of word processors 1.3.3 Creating word document 1.4 Editing and formatting word document 1.3.4 Word document editing features 1.3.4.1 Text editing 1.3.4.2 Paragraph editing 1.3.4.3 Document editing 1.4.1 Word document formatting features 1.3.4.4 Text formatting	

	1.3.4.5 Paragraph formatting 1.3.4.6 Document formatting 1.4.2 Enhancing productivity 1.3.4.7 Set basic options/ preferences 1.3.4.8 Help resources 1.3.4.9 Use magnification/zoom tools 1.3.4.10 Display, hide built-in tool bar 1.5 Mail merge 1.5.1 Mail merge preparation 1.5.2 Mail merge output 1.6 Printing of computerized word document 1.6.1 Print setup 1.6.2 Printing	
2. Manipulate computerized spreadsheet	2.1 Creation of Computerized spreadsheet workbook 2.1.1 Spreadsheet concepts 2.1.2 Elements of spreadsheet window 2.1.2.1 Worksheet 2.1.2.2 workbook 2.1.2.3 Rows 2.1.2.4 columns 2.1.2.5 Cells 2.2 Cell referencing 2.2.1.1 Relative cell referencing 2.2.1.2 Absolute cell	● Practical assessment ● Simulations ● Project ● Observation Checklist ● Product Checklist ● Written assessment ● Portfolio of evidence

	referencing 2.2.1.3 Mixed cell referencing 2.2.2 Spreadsheet editing features 2.2.2.1 Worksheet editing 2.2.2.2 Inserting rows/columns 2.2.2.3 Removing rows/columns 2.2.2.4 Adjusting row heights and column width 2.2.2.5 Inserting worksheets 2.2.2.6 Renaming worksheets 2.2.2.7 Move or copy worksheets 2.2.2.8 Deleting worksheets 2.2.3 Data manipulation in spreadsheets 2.2.3.1 Data entry 2.2.3.2 Types of data 2.3 Formulas and functions 2.3.1.1 Formulas and functions syntax 2.3.1.2 Arithmetic functions 2.3.1.3 logical functions 2.3.1.4 Look up functions	

	2.3.2 Computerized spreadsheet worksheet formatting 2.3.2.1 Font styles 2.3.2.2 Alignment 2.3.2.3 Borders and shading 2.3.2.4 Header and footer 2.4 Charts generation 2.4.1.1 Types of charts 2.4.1.2 Insert charts 2.4.1.3 Labelling and Editing charts 2.4.1.4 Computerized spreadsheet workbook printing 2.4.1.5 Print setup 2.4.1.6 Printing	
3. Maintain computerised database	3.1 Computerised database user requirements collection 3.1.1 Introduction to database 3.1.1.1 Key concepts 3.1.1.2 Database organisation 3.1.1.3 Database relationships 3.1.1.4 Database operations 3.1.2 Collection of User requirements 3.2 Design Computerised database schema 3.2.1 Creating database models 3.2.1.1 ERD models 3.2.1.2 Relational models	● Practical assessment ● Simulations ● Project ● Observation Checklist ● Product Checklist ● Written assessment ● Portfolio of evidence

	3.3 Creation of Computerised database objects 3.3.1 Database Objects 3.3.1.1 Tables 3.3.1.2 Records 3.3.1.3 Fields 3.3.1.4 Keys 3.3.1.5 Forms 3.3.1.6 Queries 3.3.1.7 Reports 3.4 Data manipulation 3.4.1 Inserting records 3.4.2 Retrieving records 3.4.3 Deleting records 3.4.4 Updating record 3.4.5 Printing database objects 3.4.5.1 Tables 3.4.5.2 Forms 3.4.5.3 Queries 3.4.5.4 Reports	
4. Prepare Power point presentation	4.1 Collection of Presentation requirements 4.1.1 Definition of terms 4.2.1 Presentation requirements 4.2.2 Types of presentation software 4.2.3 Elements of presentation window 4.2.4 Manipulating presentations 4.2.4.1 Create a PowerPoint presentation	• Practical assessment • Simulations • Project • Observation Checklist • Product Checklist • Written assessment • Portfolio of evidence

	4.2.4.2 Save a PowerPoint presentation 4.2.5 Working with presentations 4.2.5.1 Switch between open PowerPoint presentations 4.2 Design presentation layout 4.2.1 Types of presentation layout 4.2.2 Factors to consider when designing presentation layout 4.3 Creation of a Slide 4.3.1 Slide views 4.3.2 Slide designs 4.3.3 Slide transition 4.4 Manipulation of a slide 4.4.1 Adding data/text to a slide 4.4.2 Slide animation 4.4.3 Formatting data/text 4.4.4 Move/copy/delete a slide 4.4.5 Inserting header and footer 4.4.6 Presentation objects 4.2.5.2 Tables 4.2.5.3 charts 4.4.7 Print setup 4.2.5.4 Printing PowerPoint presentation	

5. Manipulate graphic application	5.1 Collecting graphic design requirements 5.1.1 Definition of terms 5.1.2 Graphic application requirements 5.1.3 Types of graphic application software 5.1.4 Types of publications designs 5.1.4.1 Templates 5.1.4.2 Banners 5.1.4.3 Booklets 5.1.4.4 Brochures 5.1.4.5 Flyers 5.1.4.6 Posters 5.1.4.7 Cards 5.1.4.8 Certificates 5.1.4.9 Magazines 5.1.5 Elements of Graphic application window 5.2 Creation of graphic design 5.2.1 Perform basic tasks using graphic application software 5.2.1.1 Publication type 5.2.1.2 Page setup 5.2.1.3 Ruler/guides 5.2.1.4 Page views 5.2.2 Add content to a publication 5.2.3 Edit content to a publication	● Practical assessment ● Simulations ● Project ● Written assessment ● Portfolio of evidence

	5.2.4 Format text and paragraphs in a publication 5.2.5 Page formatting in a publication 5.2.5.1 Columns 5.2.5.2 Borders and shading 5.2.5.3 Headers and footers 5.2.5.4 Background 5.2.5.5 Watermarks 5.2.5.6 Orientation 5.2.6 Work with graphics objects in a publication 5.2.6.1 Textbox 5.2.6.2 Tables 5.2.6.3 Shapes 5.2.6.4 Pictures 5.2.6.5 (PNG, JPEG, GIF) 5.3 Publishing of graphic design 5.3.1 Prepare a publication 5.3.2 Print setup 5.3.3 Printing publication	
6. Perform Online Collaboration	6.1 Identification of Online collaboration tools 6.1.1 Definition of online collaboration 6.1.2 Importance of online collaboration 6.1.3 Factors to consider when choosing an online collaboration tool 6.1.4 Online collaboration tools 6.1.4.1 Microsoft teams 6.1.4.2 Skype	● Practical assessment ● Simulations ● Project ● Observation Checklist ● Product Checklist ● Written assessment ● Portfolio of evidence

	6.1.4.3 Google drive 6.1.4.4 Zoom 6.1.4.5 Google meet 6.1.4.6 Slack 6.2 Online collaboration preparation 6.2.1 Online collaboration key concepts 6.2.2 Common setup features 6.2.2.1 Download software to support online collaboration tools 6.2.2.2 Register and/ or set a user account 6.2.3 Preparation for online collaboration 6.3 Application of online collaborative tools 6.3.1 Using online collaborative tools 6.3.1.1 Online storage media 6.3.1.2 Using email 6.3.1.2.1 Sending and receiving email 6.3.1.2.2 Tools and settings 6.3.1.2.3 Organizing email 6.3.1.3 Using calendars 6.3.1.4 Online calendars 6.3.1.5 Social media 6.3.1.6 Online learning environment 6.3.1.7 Synchronization tools 6.4 Demonstrating Mobile collaborations	

	6.4.1 Key concepts in mobile applications 6.4.2 Mobile applications permissions 6.4.3 Synchronization	

Suggested Delivery Methods

- Demonstration by trainer
- Practical work by trainee
- Viewing of related videos
- Group discussions
- Facilitation using active learning strategies

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
2.	Installation manuals		5 pcs	5:1
3.	Flip Charts		5 pcs	5:1
4.	PowerPoint presentations	For trainer's use		
5.	Magazines/brochures/business cards			
B	**Learning Facilities & infrastructure**			
6.	Lecture/theory room		1	25:1
7.	Laboratory		1	25:1
C	**Consumable materials**			
8.	Printing papers		1 ream	1:20
9.	Foolscaps		1 ream	
10.	Toners/cartridges		2 pcs	13:1
11.	Assorted colour of whiteboard markers			

D	**Tools and Equipment**			
12.	Computers		25 pcs	1:1
13.	Projector		1 pc	25:1
14.	Printers		2 pcs	1:13
15.	Whiteboard		1 pc	25:1
16.	Flash drives		5 pcs	5:1
17.	1 External Hard drive		1 pcs	25:1
18.	Application software suite		5 pcs	5:1

COMPUTER NETWORK DESIGN

UNIT CODE: 0612 551 02A

Relationship to Occupational Standards

This unit addresses the Unit of Competency: Design Computer Network

Unit Duration: 200 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.

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

Summary of Learning Outcomes

Learning Outcomes, Content, and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Perform Computer network site survey	1.1 Evaluation of Network infrastructure 1.1.1. Introduction to computer networks 1.1.2. Advantages and disadvantages of computer networks 1.1.3. Purpose and scope of computer networks.	• Practical Assessment • Project • Portfolio of evidence • Oral questioning • Interviews

	1.1.3.1 Scalability 1.1.3.2 Resilience 1.1.3.3 Quality of service 1.1.3.4 compatibility 1.1.4. Application of computer networks. 1.1.5. Types of computer networks. 1.1.6. Components of computer networks. 1.1.7. Types of computer networking transmission media. 1.1.8. Computer network topologies. 1.2 Identification of network needs 1.2.3 Conducting needs analysis 1.2.4 Advantages and disadvantages of network needs 1.2.5 Importance of network needs Communication 1.2.5.1 Resource sharing 1.2.5.2 Data sharing and collaboration 1.2.5.3 Internet access 1.2.5.4 Data back-up and recovery 1.2.5.5 Security 1.2.5.6 Fault tolerance and Redundancy 1.3 Fundamentals of Network Design 1.3.3 Key concepts of network design 1.3.4 Importance of network design 1.3.5 Factors to consider in network design 1.3.5.1 Security 1.3.5.2 Fault tolerance 1.3.5.3 High performance 1.3.5.4 Reliability	• Third party report • Written Assessment • Case study

	1.3.5.5 Number of users 1.3.5.6 Scalability 1.3.5.7 Performance 1.3.5.8 Flexibility 1.3.5.9 QOS 1.3.5.10 Accessibility 1.3.6 Network design tools 1.3.6.1 Software design tools 1.4 Computer network site layout design 1.4.3 Types of network sites 1.4.4 Factors to consider when designing a site layout 1.4.5 Site layout plan development 1.5 Computer network Transmission media 1.5.1 Introduction to transmission media 1.5.2 Categories of transmission media 1.5.2.1 Bound/wired 1.5.2.2 Unbound/wireless 1.5.3 Types of transmission media 1.5.3.1 Coaxial cable 1.5.3.2 Fibre Optic 1.5.3.3 Twisted pair cable 1.5.3.4 Satellite 1.5.3.5 Microwave 1.5.4 Selection criteria for transmission media 1.6 Computer network E-waste management 1.6.1 Definition of terms 1.6.2 Advantages and disadvantages of managing E-waste	

	1.6.3 Laws and regulations governing E-waste management in Kenya 1.6.4 Types of E-waste 1.6.4.1 Obsolete servers 1.6.4.2 Obsolete switches and routers 1.6.4.3 Networking cables and connectors 1.6.4.4 Obsolete computers and computer accessories 1.6.5 Procedures for disposing E-waste 1.7 Green energy in computer networking 1.7.1 Key concepts in green energy 1.7.2 Designing sustainable computer network 1.7.2.1 Renewable energy sources 1.7.2.2 Energy efficient hardware 1.7.2.3 Virtualization and Consolidation 1.7.2.4 Energy aware routing 1.7.2.5 Energy monitoring and reporting 1.7.3 Pros and cons of green energy in computer networking	
2. Design Computer network topology.	2.1 Network plan design. 2.1.1 Floor design 2.1.2 Wireless design 2.2 Tools and components for designing computer networks. 2.2.1 Tools for designing computer networks 2.2.1.1 Software tools	● Practical Assessment ● Project ● Portfolio of evidence ● Oral questioning ● Interviews ● Third party report

	2.2.2 Computer network components and their functions 2.2.2.1 Gateways 2.2.2.2 NIC 2.2.2.3 Router 2.2.2.4 Switch 2.2.2.5 Modem 2.2.2.6 Firewall 2.2.2.7 Wireless access point 2.2.2.8 Repeaters 2.3 Determining network device location 2.3.1 IEEE Standards Requirements 2.3.2 Determining Device location Placement 2.3.2.1 Switch 2.3.2.2 Router 2.3.2.3 Wireless Access points 2.4 Computer network topology design 2.4.1 Key Concepts 2.4.2 Types of network topology 2.4.2.1 Star 2.4.2.2 Ring 2.4.2.3 Bus 2.4.2.4 Mesh 2.4.2.5 Hybrid 2.4.3 Criteria for selecting network topology design	● Written Assessment ● Case study
3. Document Computer network configurations	3.1 Computer Network documentation policy.(IEEE 802.11, 802.3) 3.1.1 Network performance report 3.1.2 Security report 3.1.3 Inventory report 3.1.4 Usage report 3.1.5 Incident report	● Practical Assessment ● Project ● Portfolio of evidence ● Oral questioning ● Interviews

	3.2 Computer Network topology diagram 3.2.1 Physical topology diagrams 3.3 Network Mapping documentation 3.3.1 Device names, roles and IP address documentation.	• 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**			
1.	Textbooks		13 pcs	2:1
2.	Installation manuals			
3.	Flip Charts			
4.	PowerPoint presentations	For trainer's use		
B	**Learning Facilities & infrastructure**			
5.	Lecture/theory room		1	25:1
6.	Laboratory		1	25:1
C	**Consumable materials**			
7.	Printing papers		1 ream	1:20
8.	Toners/Cartridges		2 pcs	13:1
9.	Assorted colour of whiteboard markers			
D	**Tools and Equipment**			
1.	Computers		25 pcs	1:1

2.	Projector		1 pc	25:1
3.	Signal testers		5 pcs	5:1
4.	Header checker		25 pcs	1:1
5.	Crimping tools		13 pcs	2:1
6.	Cable tester		5 pcs	5:1
7.	Punch Downs		5 pcs	5:1
8.	Switches		5pcs	5:1
9.	Repeaters		5pcs	5:1
10.	Routers/modem		5pcs	5:1
11.	Network tool kit		25 pcs	1:1
12.	Gateways		5pcs	5:1
13.	Packets of RJ45		300 pcs	1:10
14.	Fibre Modules (SFP)		5pcs	5:1
15.	UTP Ethernet Cable		300 meters	1:10
16.	Antistatic gloves		25 pairs	1:1

COMPUTER REPAIR AND MAINTENANCE

UNIT CODE: 0714 551 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.

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

Summary of Learning Outcomes

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Perform computer troubleshooting	1.1. User data assessment 1.1.1. Introduction to computer repair and maintenance 1.1.2. Documenting faulty computer user data 1.2. Computer problems identification	• Practical assessment • Project • Observation Checklist • Product Checklist

	1.2.1. Computer troubleshooting approaches 1.2.2. Basic computer hardware faults 1.2.3. Methods of information gathering 1.2.4. User data analysis 1.3. Determining solution to the problem 1.3.1. Computer hardware faults remedies 1.3.2. Test hypothesis 1.3.3. Problem Identification 1.3.4. Documentation of solution	• Written assessment • Portfolio of evidence
2. Repair faulty components.	2.1 Selection of computer components for replacement 2.1.1 Computer hardware components 2.1.1.1 Factors to consider in selecting computer components 2.1.1.2 computer hardware components parts acquisition 2.2 Assembly of tools for repairing or replacing 2.2.1 Computer repair and maintenance tools 2.2.1.1 Straight-head screwdriver, large and small 2.2.1.2 Phillips-head screwdriver, large and small 2.2.1.3 Tweezers or part retriever 2.2.1.4 Needle-nosed pliers 2.2.1.5 Wire cutters 2.2.1.6 Chip extractor 2.2.1.7 Hex wrench set 2.2.1.8 Torx screwdriver 2.3 Observation of Safety procedures 2.3.1 Safety measures and procedures 2.3.1.1 Personal Protective Equipment's 2.3.1.2 Proper use of tools and equipment	• Practical assessment • Project • Observation Checklist • Product Checklist • Written assessment • Portfolio of evidence

	2.3.1.3 Fire safety 2.3.1.4 Classes of fires 2.3.1.5 Fire extinguishers 2.3.1.6 Emergency procedures 2.3.1.7 First AID kit 2.3.1.8 Emergency contact 2.3.1.9 Contingency measures 2.4 Repair and replacing computer components 2.4.1 Computer components Instruction manuals 2.4.2 Computer components disassembly process 2.4.3 Reassembling repaired or replaced computer components 2.5 Disposing faulty or obsolete computer hardware components 2.5.1 Pollution 2.5.2 E- waste 2.5.3 Hazards 2.5.4 Types of E-waste 2.5.5 Proper disposal methods	
3. Test computer component functionality	3.1 Performing POST on computer 3.2 Performing computer component test 3.2.1 Importance of testing 3.2.2 Testing techniques 3.2.2.1 Testing of repaired or replaced components 3.2.3 Evaluation of test Results 3.3 Computer component's functionality report 3.3.1 Generation of test results report	• Practical assessment • Project • Observation Checklist • Product Checklist • Written assessment • Portfolio of evidence

4. Perform computer maintenance	4.1 Computer maintenance scheduling 4.1.1 Introduction to computer maintenance 4.1.1.1 Definition of computer maintenance 4.1.1.2 Importance of computer maintenance 4.1.2 Types of computer maintenance 4.1.3 Prepare computer maintenance schedule 4.2 Performing computer maintenance 4.2.1 Computer maintenance utilities 4.2.2 Uses of computer maintenance utilities 4.2.3 Perform computer maintenance 4.3 Computer maintenance report 4.3.1 Importance of computer maintenance report 4.3.2 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			
1.	Textbooks		5 pcs	5:1
2.	Installation manuals		5 pcs	5:1
3.	Flip Charts		5 pcs	5:1
4.	PowerPoint presentations	For trainer's use		
5.	Magazines/brochures/business cards			
B	Learning Facilities & infrastructure			
6.	Lecture/theory room		1	25:1
7.	Computer Laboratory		1	25:1
C	Consumable materials			
8.	Printing papers		1 ream	1:20
9.	Foolscaps		1 ream	
10.	Toners		2 pcs	13:1
11.	Assorted colour of whiteboard markers			
D	Tools and Equipment			
12.	Computers		25 pcs	1:1
13.	Projector		1 pcs	25:1
14.	Printers		2 pcs	13:1
15.	Whiteboard		1 pcs	25:1
16.	Flash drives		5 pcs	5:1
17.	1 External Hard drive		1 pcs	25:1
18.	Computer Repair Tool box		5	5:1

MODULE II

UNIT CATEGORY	UNIT CODE	UNIT NAME	DURATION (Hours)
CORE	0612 551 04A	Computer Network Setup	200
CORE	0612 551 05A	Computer Network Software Installation	220
		Total	**420**

COMPUTER NETWORK SETUP

UNIT CODE: 0612 551 04A

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 assembling network components, testing the network, documenting the configurations and conducting user training.

Summary of Learning Outcomes

LEARNING OUTCOMES	DURATION (HOURS)
1. Setup Computer Network	50
2. Test Computer Network Connectivity	50
3. Document Computer Network Configurations	50
4. 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.	1.1 Network Components 1.1.1 Introduction to network components 1.1.2 Examples of network components 1.1.2.1 Router 1.1.2.2 Switch 1.1.2.3 Hub 1.1.2.4 Modem 1.1.2.5 Firewall 1.1.2.6 Access point	● Practical test ● Project ● Portfolio of evidence ● Oral questioning ● Interviews ● Third party report ● Written tests ● Case study

	1.1.2.7 Server 1.1.2.8 Cable 1.1.2.9 Wireless adapter 1.1.3 Identifications of network tools 1.1.3.1 Crimping tool 1.1.3.2 Cable tester 1.1.3.3 Wire stripper 1.1.3.4 Multimeter 1.1.3.5 Screwdriver set 1.1.3.6 Ethernet cable and connectors 1.2 Networking standards 1.2.1 Introduction to Cable termination IEEE 802.3 standards 1.2.2 Type of cable termination standards 1.2.2.1 T568A, 1.2.2.2 T568B 1.2.3 Methods of cable termination 1.2.3.1 Crimped termination 1.2.3.2 Compression termination 1.2.3.3 Wire-wrap termination 1.2.3.4 Insulation displacement 1.3 Network components and network devices configuration as per IEEE standards ➢ IP addressing ➢ Routing configuration ➢ Network security 1.3.1 Wireless network configuration	

2. Test Computer network connectivity	2.1 Network Component performance testing 2.1.1 Types of computer network component tests 2.1.1.1 Performance testing 2.1.1.2 Functionality testing 2.1.1.3 Security testing 2.1.1.4 Resilience and Recovery Testing 2.1.1.5 connectivity testing 2.1.1.6 Media testing 2.1.1.7 Bandwidth testing 2.2 Network Performance test 2.3 Network testing reports 2.3.1 Types of network reporting. 2.3.1.1 Network performance test report 2.3.1.2 Security vulnerability assessment report 2.3.1.3 Quality of service test report 2.3.1.4 Incidence response exercise report 2.4 Computer network Transmission media 2.4.1 Introduction to transmission media 2.4.2 Categories of transmission media 2.4.2.1 Bound/wired 2.4.2.2 Unbound/wireless 2.4.3 Types of transmission media 2.4.3.1 Coaxial cable 2.4.3.2 Fibre Optic 2.4.3.3 Twisted pair 2.4.3.4 Satellite 2.4.3.5 Microwave	● Practical test ● Project ● Portfolio of evidence ● Oral questioning ● Interviews ● Third party report ● Written tests ● Case study

	2.4.4 Selection criteria for transmission media 2.4.5 Types of network transmission media testing 2.4.5.1 Cable continuity testing 2.4.5.2 Crosstalk test 2.4.5.3 Bandwidth and throughput testing 2.4.5.4 Signal quality testing 2.4.5.5 Wireless media testing	
3. Document Computer network configurations	3.1 Network component configuration documentation 3.1.1. Importance of network configuration documentation. 3.1.2. Types of documentations. 3.1.2.1 Device configuration 3.1.2.2 Network topologies 3.1.2.3 Security configuration. 3.2 Introduction Network data points 3.2.2 Types of Network Data Points 3.2.2.1 Ethernet ports 3.2.2.2 Coaxial cable outlets 3.2.2.3 Fibre optic terminals 3.2.3 Importance of Network Data Points 3.2.4 Factors to Consider When Installing Network Data Points 3.2.5 Common Applications of Network Data Points 3.2.6 Best practices for data points management 3.3 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

4. Conduct Computer Network user training	4.1 Basic network navigation training 4.1.1 Importance of network user training. 4.1.2 Types of network training materials 4.1.3 Preparing for the network user training. 4.1.4 Types of user training. 4.1.5 Conducting network user training. 4.2 Network troubleshooting 4.2.1 Importance of network trouble shooting 4.2.2 Common issues in network trouble shooting 4.2.3 Network troubleshooting process 4.2.4 Network troubleshooting tools 4.2.5 Troubleshooting methodology 4.3 Data backup and recovery 4.3.1 Data identification and classification 4.3.2 Backup strategy design 4.3.3 Selection of backup solutions 4.3.4 Implementation of backup procedures 4.3.5 Regular backup execution 4.3.6 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**			
1.	Textbooks		13 pcs	2:1
2.	Installation manuals			
3.	Flip Charts			
4.	PowerPoint presentations	For trainer's use		
B	**Learning Facilities & infrastructure**			
5.	Lecture/theory room		1	25:1
6.	Laboratory		1	25:1
C	**Consumable materials**			
7.	Printing papers		1 ream	1:20
8.	Toners/Cartridges		2 pcs	13:1
9.	Assorted colour of whiteboard markers			
D	**Tools and Equipment**			
17.	Computers		25 pcs	1:1
18.	Projector		1 pc	25:1
19.	Signal testers		5 pcs	5:1
20.	Header checker		25 pcs	1:1
21.	Crimping tools		13 pcs	2:1
22.	Cable tester		5 pcs	5:1
23.	Punch Downs		5 pcs	5:1
24.	Switches		5pcs	5:1
25.	Repeaters		5pcs	5:1
26.	Routers/modem		5pcs	5:1
27.	Network tool kit		25 pcs	1:1
28.	Gateways		5pcs	5:1
29.	Packets of RJ45		300 pcs	1:10
30.	Fibre Modules (SFP)		5pcs	5:1
31.	UTP Ethernet Cable		300 meters	1:10
32.	Antistatic gloves		25 pairs	1:1

COMPUTER NETWORK SOFTWARE INSTALLATION

UNIT CODE: 0612 551 05A

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 performing computer software installation, testing computer network software and conducting computer network software user training.

Summary of Learning Outcomes

LEARNING OUTCOMES	DURATION (HOURS)
1. Conduct Network Software Simulation	30
2. Perform Computer Network Software Installation	30
3. Test Computer Network Software	30
4. Conduct Computer Network Software User Training	50
5. 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 .	1.1 Computer network software requirements 1.1.1 Introduction to computer software 1.1.2 Computer network software 1.1.2.1 Network protocols and services 1.1.2.2 Operating systems 1.1.2.3 Network management software 1.1.2.4 Remote desktop software	

	1.1.2.5 Network backup and recovery software 1.1.2.6 VoIP software 1.2 Introduction to Installation and configuration of Computer network simulation Software 1.2.1 Types of Computer network simulation Software 1.2.1.1 Cisco (packet tracer) 1.2.1.2 Graphical Network Simulator 1.2.1.3 Wire shark 1.2.2 Uses of network simulators 1.2.3 Best practices in Installation and configuration of Computer network simulation Software 1.3 Basic Network Simulations activities 1.3.1 Simple Network Design 1.3.2 Troubleshooting Network Issues 1.3.3 Configuring Basic Protocols	
2. Perform Computer Network software installation	2.1 Network operating system Installation 2.1.1 Introduction to computer Network operating system 2.1.2 Functions of a NOS 2.1.2.1 File Sharing 2.1.2.2 Print Sharing 2.1.2.3 Resource Management 2.1.2.4 Security 2.1.2.5 Network Management 2.1.3 Features of Using a NOS 2.1.3.1 User authentication and authorization: 2.1.3.2 File and directory services 2.1.3.3 Network security 2.1.3.4 Backup and recovery	● Practical test ● Project ● Portfolio of evidence ● Oral questioning ● Interviews ● Third party report ● Written tests ● Case study

	2.1.3.5 Remote management 2.1.3.6 Monitoring and reporting 2.1.4 Benefits of Using a NOS 2.1.4.1 Improved network performance 2.1.4.2 Enhanced security 2.1.4.3 Simplified network management 2.1.4.4 Increased collaboration 2.1.4.5 Cost savings 2.2 Network monitoring and management tools 2.2.1 Network management tools 2.2.1.1 FortiManager 2.2.1.2 OpManager Plus 2.2.1.3 Azure Virtual 2.2.1.4 WANQuantum Spark Security Management Portal 2.2.2 Network monitoring tools 2.2.2.1 Paessler PRTG Network Monitor 2.2.2.2 Progress WhatsUp Gold 2.2.2.3 Nagios XILogicMonitor 2.2.2.4 SolarWinds Network 2.2.2.5 Performance Monitor 2.2.2.6 Wireshark 2.2.2.7 Nagios 2.2.2.8 Zabbix 2.2.2.9 Cisco Prime Infrastructure 2.3 Network monitoring tools configuration 2.3.1 Types of network monitoring tools 2.3.1.1 Traffic monitoring tools 2.3.1.2 Performance monitoring tools	

	2.3.1.3 Security monitoring tools 2.3.2 Network monitoring tools configuration strategies	
3. Test Computer Network Software	3.1 Network Software Testing 3.1.1 Meaning and importance of software testing. 3.1.2 Types of computer network Software testing performed as per user requirements 3.1.2.1 Exploratory testing 3.1.2.2 Test case design 3.1.2.3 Defect reporting 3.1.2.4 Performance testing 3.1.2.5 Security testing 3.1.2.6 User acceptance testing 3.1.2.7 Functionality test 3.1.3 Continuous Improvement of Computer Network Software 3.1.3.1 Regular Reviews 3.1.3.2 Security Awareness 3.1.3.3 Training Incident Response Plan 3.1.3.4 Proactive Monitoring 3.2 Performing Corrective Actions on Computer Network Software 3.2.1 Corrective actions 3.2.2 Patch Management 3.2.3 Configuration Management 3.2.4 Security Measures 3.2.5 Network Troubleshooting 3.2.6 Performance Optimization 3.2.7 Backup and Recovery 3.2.8 Continuous Improvement of Computer Network Software	• Practical test • Project • Portfolio of evidence • Oral questioning • Interviews • Third party report • Written tests • Case study

	3.2.8.1 Regular Reviews 3.2.8.2 Security Awareness 3.2.8.3 Training Incident Response Plan 3.2.8.4 Proactive Monitoring 3.3 Introduction to Computer software functionality test report 3.3.1 Steps in conducting Computer software functionality test 3.3.2 Computer software Functional testing types 3.3.2.1 Unit testing 3.3.2.2 Smoke testing 3.3.2.3 User acceptance 3.3.2.4 Regression testing 3.3.2.5 Localization testing	
4. Conduct Computer Network software user training	4.1 User skill gap 4.1.1 Meaning of skill gap in computer networks 4.1.2 Identification of skill gap in computer networks 4.2 User training manuals 4.2.1 Definition of training manual 4.2.2 Types of computer network training manuals 4.2.2.1 Cisco network training manual 4.2.2.2 Microsoft certified network engineer associates 4.2.2.3 Linux network training manual 4.3 Network user training 4.3.1 Key Concepts Network user training 4.3.1.1 Basic network concepts and terminologies	● Practical test ● Project ● Portfolio of evidence ● Oral questioning ● Interviews ● Third party report ● Written tests ● Case study ● Written tests ● Case study

	4.3.1.2 Connecting to the networks 4.3.1.3 Network security best practices 4.3.1.4 Resources access and file sharing 4.3.1.5 Performance optimization 4.4 Training reports 4.4.1 Meaning and identification of computer networks training reports. 4.4.2 Types of computer networks training reports 4.4.2.1 Training evaluation report 4.4.2.2 Training completion report	
5. Monitor computer network software performance	5.1 Real-time network monitoring 5.1.1 Types of network software performance real –time monitoring. 5.1.1.1 SNMP 5.1.1.2 Packet sniffers 5.1.1.3 Performance monitoring tools 5.1.1.4 Flow-based analytics 5.2 Bandwidth and Throughput analysis 5.2.1 Definition of Bandwidth and Throughput 5.2.2 Factors Affecting Throughput analysis 5.2.2.1 Network Congestion 5.2.2.2 Network Congestion 5.2.2.3 Latency 5.2.2.4 Packet Loss 5.2.2.5 Protocol Overhead 5.2.2.6 Hardware Limitations 5.2.3 Tools for measuring and optimizing throughput and bandwidth	o Practical test o Project o Portfolio of evidence o Oral questioning o Interviews o Third party report o Written tests o Case study o Written tests o Case study

	5.2.4 Network performance monitoring tools 5.2.4.1 Speed test applications 5.2.4.2 Quality of service 5.2.4.3 Traffic analysis 5.2.4.4 Bandwidth management and control tools 5.2.4.5 Predictive analytics and capacity planning tools 5.2.5 Best practices for managing bandwidth and throughput 5.3 Network Alerts and notifications 5.3.1 Types of Network Alerts and notifications 5.3.1.1 Security alerts 5.3.1.2 Performance alerts 5.3.1.3 Hardware alerts 5.3.1.4 Configuration alerts	

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**			
1.	Textbooks		13 pcs	2:1

2.	Installation manuals			
3.	Flip Charts			
4.	PowerPoint presentations	For trainer's use		
B	**Learning Facilities & infrastructure**			
5.	Lecture/theory room		1	25:1
6.	Laboratory		1	25:1
C	**Consumable materials**			
7.	Printing papers		1 ream	1:20
8.	Toners/Cartridges		2 pcs	13:1
9.	Assorted colour of whiteboard markers			
D	**Tools and Equipment**			
10.	Computers		25 pcs	1:1
11.	Projector		1 pc	25:1
12.	Flash drives		25 pairs	1:1
13.	External CD/DVD drives		13 pcs	2:1

MODULE III

UNIT CATEGORY	UNIT CODE	UNIT NAME	DURATION (Hours)
CORE	0612 551 06A	Computer Network Security Configuration	210
CORE	0612 551 07A	Computer Network Maintenance	210
		Grand total	**420**

COMPUTER NETWORK SECURITY CONFIGURATION

UNIT CODE: 0612 551 06A

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
2. Perform Computer Network Segmentation	60
3. Configure Computer Network Firewall	60
4. 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 .	1.1 Inventory of computer network 1.1.1 Introduction of computer network inventory. 1.1.2 Types of computer network inventory. 1.1.2.1 Hardware inventory	● Practical test ● Project ● Portfolio of evidence

	1.1.2.2 Software inventory 1.1.2.3 IP address inventory 1.1.2.4 Device configuration inventory 1.2 Identify and prioritize security threats and vulnerabilities 1.2.1 Introduction to computer network, security threats and vulnerabilities. 1.2.2 Categories of computer network, security threats 1.2.2.1 Internal (Outdated or unpatched software Misconfigured firewalls / operating systems, Denial of service, Man in the middle attack etc) 1.2.2.2 External (Malware attacks, Social engineering attacks, Phishing etc) 1.2.3 Types of computer network vulnerabilities. 1.3 Develop security Controls 1.3.1 Introduction to computer network security controls. 1.3.2 Types of computer network security controls. 1.3.2.1 Preventive 1.3.2.2 Detective controls 1.3.2.3 Corrective controls 1.3.2.4 Deterrent controls 1.3.2.5 Compensating controls 1.3.2.6 Administrative control 1.3.2.7 Logical/technical control 1.3.2.8 Physical controls 1.3.2.9 Technological controls 1.4 Risk assessment documentation	● Oral questioning ● Interviews ● Third party report ● Written tests ● Case study

	1.4.1 Meaning of computer network Risk Assessment Report 1.4.2 Types of computer network Risk Assessment Report. 1.4.2.1 Qualitative Risk Assessment Report 1.4.2.2 Quantitative Risk Assessment Report 1.4.2.3 Operation Risk Assessment Report	
2. Perform computer network segmentation	2.1 IP addressing scheme. 2.1.1 IP addressing and subnetting 2.1.2 IP address fundamentals 2.1.2.1 Physical address. MAC address. 2.1.2.2 Logical address. IP address. 2.1.2.3 Hostname. 2.1.2.4 IPv4 vs. IPv6 2.1.2.5 Classful addressing 2.1.2.6 Static vs. Dynamic IP Addressing 2.1.2.7 Public vs. Private IP Addresses 2.1.3 Steps in Designing an IP Addressing Scheme 2.2 Network segmentation 2.2.1 Introduction to network segmentation 2.2.1.1 Definition of network segmentation 2.2.1.2 Physical & logical segmentation 2.2.1.3 Importance of network segmentation 2.2.2 Types of network segmentation 2.2.2.1 IP based 2.2.2.2 VLANs 2.2.2.3 Subnetting 2.2.2.4 Firewalls 2.2.2.5 Physical segmentation	● Practical test ● Project ● Portfolio of evidence ● Oral questioning ● Interviews ● Third party report ● Written tests ● Case study

	2.2.3 Tools and techniques for network segmentation 2.2.3.1 Firewalls, Routers, and Access Control Lists (ACLs) 2.2.3.2 Network Access Control (NAC) 2.2.4 Monitoring and Managing Network Segments 2.3 Network privileges. 2.3.1 Introduction to network privilege management 2.3.1.1 Definition of Network Privileges. 2.3.1.2 Roles of network privileges. 2.3.2 Types of Network Privileges: 2.3.2.1 Read, Write, Execute 2.3.3 Roles of Privilege Management in Network Security 2.3.3.1 Administrator privileges 2.3.3.2 User privileges 2.3.3.3 Read-only access 2.3.3.4 Remote access privileges 2.3.4 implementation of network access control 2.3.5 Understand Network Access Requirements 2.3.6 Develop Access Control Policies 2.3.7 Select a Network Access Control Solution	
3. Configure network firewall	3.1 Firewall security 3.1.1 Introduction to firewall security 3.1.2 Types of firewall security 3.1.2.1 Hardware firewall 3.1.2.2 Software firewall 3.1.2.3 Cloud firewall	● Practical test ● Project ● Portfolio of evidence ● Oral questioning

	3.1.2.4 Open-source firewall 3.1.3 Firewall architecture and components 3.2 Firewall Zone and IP address 3.2.1 Types of firewall zones 3.2.2 IP address structure 3.2.2.1 Network ID 3.2.2.2 Hosting ID 3.3 Access Control list 3.3.1 Network Access Control List (ACL)Concepts 3.3.1.1 Purpose of ACLs 3.3.1.2 Wildcard mask in ACLs 3.3.1.3 Types of IPv4 ACLs 3.4 Login and Firewall services 3.4.1 Firewall login and configuration concepts 3.4.2 Types of firewall services 3.4.2.1 Packet filtering 3.4.2.2 Stateful inspection 3.4.2.3 Application-level gateway 3.4.2.4 Virtualization 3.5 Firewall Configuration 3.5.1 Concepts of Firewall configuration 3.5.2 Steps of Firewall configuration 3.5.3 Best practices for firewall configuration 3.5.4 Objectives of firewall testing 3.5.5 Steps of Firewall testing 3.5.6 Tools for Firewall testing 3.5.7 Best practices for firewall testing 3.6 Firewall management 3.6.1 Concepts of firewall management 3.6.1.1 Firewall maintenance 3.6.1.2 Firewall monitoring	● Interviews ● Third party report ● Written tests ● Case study ● Written tests ● Case study

	3.6.1.3 Compliance and auditing 3.6.1.4 Firewall documentation	
4. Conduct Computer Network security user training	4.1 Security Awareness 4.1.1 Introduction to computer network security awareness 4.1.2 User and customer training methods 4.2 Network security implementation 4.2.1 User training on implementation of Network security practices 4.2.1.1 Network security policies 4.2.1.2 Network security best practices 4.2.1.3 Network segmentation user training 4.2.1.4 Firewall implementation 4.3 Incidence Responses 4.3.1 User training on computer network incident response. 4.3.2 Types of computer network incident response 4.3.3 Components of incident response training for users 4.3.4 Incident response team functions and responsibilities 4.4 Regular updates 4.4.1 User training on computer networks regular updates. 4.4.2 Patch management 4.5 Network Compliance training 4.5.1 Concepts of computer networks Compliance training. 4.5.2 Legal and regulatory requirement. 4.5.3 Compliance policies and procedures	● Practical test ● Project ● Portfolio of evidence ● Oral questioning ● Interviews ● Third party report ● Written tests ● Case study

	4.5.4 Compliance monitoring and auditing 4.5.5 Emerging trends in computer network compliance 4.6 Network testing and simulation 4.6.1 Introduction to network testing and simulation. 4.6.2 Components of network testing and simulation. 4.6.2.1 Network performance testing 4.6.2.2 Network security testing 4.6.2.3 Network simulation techniques	

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**			
1.	Textbooks		13 pcs	2:1
2.	Installation manuals			
3.	Flip Charts			
4.	PowerPoint presentations	For trainer's use		
B	**Learning Facilities & infrastructure**			
5.	Lecture/theory room		1	25:1
6.	Laboratory		1	25:1

C	**Consumable materials**			
7.	Printing papers		1 ream	1:20
8.	Toners/Cartridges		2 pcs	13:1
9.	Assorted colour of whiteboard markers			
D	**Tools and Equipment**			
10.	Computers		25 pcs	1:1
11.	Projector		1 pc	25:1
12.	Flash drives		25 pairs	1:1
13.	External CD/DVD drives		13 pcs	2:1

COMPUTER NETWORK MAINTENANCE

UNIT CODE: 0612 451 07A

Relationship to Occupational Standards

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

Unit Duration: 210 Hours

Unit Description

This unit covers the competencies required to perform computer network repair and maintenance. It involves 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
2. Troubleshoot Computer Network Component	70
3. Perform Computer Network Components Repair	60
4. Maintain Computer Network	40
TOTAL	**210**

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Analyze Computer Network Performance	1.1 Computer Network Traffic analysis. 1.1.1 Introduction to network traffic analysis 1.1.2 Concepts and metrics in network traffic analysis 1.1.3 Types of Network Traffic and Protocols	• Practical test • Project • Portfolio of evidence • Oral questioning • Interviews

	1.1.4 TCP/IP, UDP, ICMP and other common protocols 1.1.4.1 Unicast traffic 1.1.4.2 Broadcast traffic 1.1.4.3 Multicast traffic 1.1.5 Tools for Network Traffic Analysis 1.1.5.1 Wireshark, 1.1.5.2 tcpdump, 1.1.5.3 SolarWinds, NetFlow 1.1.6 Implementation of network traffic analysis 1.1.6.1 Locate all key network components 1.1.6.2 Using network monitoring software 1.1.6.3 Create alerts for component health and metrics 1.1.6.4 Bandwidth monitoring 1.1.6.5 Packet inspection 1.1.6.6 Performance optimization 1.1.6.7 Forensic analysis 1.1.6.8 Real-time monitoring and alerts 1.2 Network Bandwidth utilization monitoring 1.2.1 Introduction to Network Bandwidth Utilization 1.2.2 Definition of terms 1.2.2.1 Monitoring 1.2.2.2 bandwidth, 1.2.2.3 throughput, 1.2.2.4 latency, 1.2.2.5 packet loss 1.2.3 Bandwidth Monitoring Tools and Technologies	• Third party report • Written tests • Case study

	1.2.3.1 NetFlow, 1.2.3.2 PRTG, 1.2.3.3 SolarWinds 1.2.3.4 Web browsing monitoring 1.2.3.5 File downloads monitoring 1.3 Computer network Latency measurement 1.3.1 Introduction to Network Latency Measurement 1.3.2 Definition of terms 1.3.2.1 Network latency 1.3.2.2 jitter, 1.3.2.3 round-trip time (RTT) 1.3.3 Types of Latency and measurements 1.3.4 Tools for Network Latency Measurement 1.3.4.1 Ping 1.3.4.2 Traceroute 1.3.4.3 Wireshark 1.3.4.4 Network monitoring tools 1.4 Network Device performance monitoring 1.4.1 Introduction to Network Device Performance Monitoring 1.4.2 Importance of monitoring network devices 1.4.3 Network monitoring criteria 1.4.3.1 CPU usage, 1.4.3.2 Memory utilization, 1.4.3.3 Bandwidth, 1.4.3.4 Error rates 1.4.4 Key concepts for Monitoring Network Devices 1.4.4.1 Metrics tracking 1.4.4.2 Alerting	

	1.4.4.3 Real-time monitoring 1.4.4.4 Security monitoring 1.4.4.5 Latency, packet loss, error rates, and uptime 1.4.4.6 memory and CPU usage in network device 1.4.5 Network Device Performance Optimization Techniques 1.4.6 Optimizing device settings for better performance. 1.4.7 Implementing load balancing to reduce device load. 1.4.8 Adjusting network topology for optimal device performance.	
2. Troubleshoot computer network components	2.1 Basic Electronic skills 2.1.1 Introduction to basic electronic skills 2.1.1.1 Electricity and circuits Components 2.1.1.2 Electronic devices 2.1.1.3 Power supplies 2.1.1.4 Analog and Digital signals 2.1.1.5 Electronic measurement 2.1.1.6 Safety and practical considerations 2.2 Network component testing 2.2.1 Types of network components tests 2.2.1.1 Cable continuity test 2.2.1.2 Connectivity test 2.2.1.3 Performance test 2.2.1.4 Security test 2.2.1.5 Load test 2.2.1.6 Protocol test 2.3 Network Configuration verification	● Practical test ● Project ● Portfolio of evidence ● Oral questioning ● Interviews ● Third party report ● Written tests ● Case study

	2.3.1 Concepts of Network configuration verification 2.3.2 Understanding network topologies 2.3.3 Device configuration checks 2.3.4 Network service configuration checks 2.3.5 Security configurations checks 2.3.6 Performance testing checks 2.4 Network Logging and error message review 2.5 Preparation of network troubleshooting Report	
3. Perform computer network component repair	2.6 Safety measures 2.6.1 Introduction to computer network Safety measures 2.7 Faulty network component 2.7.1 Importance of network maintenance 2.7.2 Types of computer network components faults 2.7.2.1 Switch faults 2.7.2.2 Router fault 2.7.2.3 Cabling faults 2.7.2.4 Server faults 2.8 Computer network problem-solving procedure 2.8.1 Network components Troubleshooting process 2.8.2 Types of network component repair 2.9 Network monitoring and maintenance tools 2.10 Faults Identifications 2.10.1 Procedures of identifying network faults	● Practical test ● Project ● Portfolio of evidence ● Oral questioning ● Interviews ● Third party report ● Written tests ● Case study ● Written tests ● Case study

	2.10.2 Types of network faults 2.10.2.1 Transmission errors 2.10.2.2 Network latency 2.10.2.3 Hardware faults 2.10.2.4 Protocol faults 2.10.2.5 Configuration errors 2.10.2.6 Data packet loss 2.10.3 Possible Solution for computer networks faults 2.11 Network component repair 2.11.1 General network components Repair procedures 2.11.1.1 Diagnosis 2.11.1.2 Isolation 2.11.1.3 Repair process 2.11.1.4 Documentation 2.11.2 Best practices for network component repair 2.12 E-waste Management 2.12.1 Network components disposal methods 2.12.1.1 Recycling 2.12.1.2 Donation 2.12.1.3 Incineration 2.12.2 Emerging trends in E-waste disposal	
4. Maintain computer network	4.1 Network Hardware and Software maintenance 4.1.1 Introduction to computer networks hardware and software maintenance 4.1.2 Types of hardware and software maintenance 4.1.2.1 Preventive	● Practical test ● Project ● Portfolio of evidence ● Oral questioning ● Interviews

	4.1.2.2 Adaptive 4.1.2.3 Corrective 4.1.2.4 Predictive 4.2 Network Monitoring 4.2.1 Concepts of Network monitoring and Performance optimization 4.2.2 Types of network monitoring 4.2.2.1 SNMP monitoring 4.2.2.2 Flow based monitoring 4.2.2.3 Packet capture and monitoring 4.2.3 Types Network monitoring tools 4.2.4 Best practices for network monitoring and performance optimization 4.3 Backup and disaster recovering 4.3.1 Introduction to network disaster recovery 4.3.2 Types of network backup 4.3.2.1 Full backup 4.3.2.2 Incremental backup 4.3.2.3 Deferential backup 4.3.3 Disaster recovery planning 4.3.4 Backup and disaster recovery tools 4.3.5 Best practices for backup and disaster recovery 4.4 Documentation and inventory maintenance 4.4.1 Types of documentation 4.4.1.1 Network documentation 4.4.1.2 Network inventory 4.4.2 Best practices for network documentation and inventory	● Third party report ● Written tests ● Case study

	4.5 Computer network compliance and regulatory updates 4.5.1 Common regulations affecting computer networks 4.5.2 Regulatory Updates in network compliance 4.5.3 Best practices forkeep up with compliance and regulatory updates 4.5.3.1 Regular audit and reviews 4.5.3.2 Continuous monitoring and threat detection 4.5.4 User training	

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**			
1.	Textbooks		13 pcs	2:1
2.	Installation manuals			
3.	Flip Charts			
4.	PowerPoint presentations	For trainer's use		
B	**Learning Facilities & infrastructure**			
5.	Lecture/theory room		1	25:1
6.	Laboratory		1	25:1

C	**Consumable materials**			
7.	Printing papers		1 ream	1:20
8.	Toners/Cartridges		2 pcs	13:1
9.	Assorted colour of whiteboard markers			
D	**Tools and Equipment**			
10.	Computers		25 pcs	1:1
11.	Projector		1 pc	25:1
12.	Flash drives		25 pairs	1:1
13.	External CD/DVD drives		13 pcs	2:1

MODULE IV

UNIT CATEGORY	UNIT CODE	UNIT NAME	DURATION (Hours)
CORE	0612 551 08A	Computer Network Security Monitoring	220
COMMON	0714 541 09A	Basic Electronics	100
BASIC	0417 551 10A	Work Ethics and Practices	40
TOTAL			**360**

COMPUTER NETWORK SECURITY MONITORING

UNIT CODE: 0612 551 08A

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
2. Monitor Computer Network Firewall activities	90
3. 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	1.1 Network Security Threats & Vulnerabilities 1.1.1 Introduction to computer network security 1.1.2 Importance of computer network security 1.1.2.1 Preventing unauthorized access: 1.1.2.2 Protecting data integrity: 1.1.2.3 Ensuring business continuity: 1.1.3 Types of network security threats and vulnerabilities 1.1.3.1 Malware 1.1.3.2 Phishing 1.1.3.3 Man in the middle attack 1.1.3.4 Denial of service attack 1.1.3.5 SQL injection 1.1.3.6 Weak authentication and authorization 1.1.3.7 Physical security threats 1.2 Network Security Controls 1.2.1 Types of computer network security controls 1.2.1.1 Preventive controls 1.2.1.2 Detective controls 1.2.1.3 Corrective controls 1.2.2 Implementation of computer network security controls 1.2.2.1 Physical controls • Lock & Keys • Biometrics	2 Practical test 3 Project 4 Portfolio of evidence 5 Oral questioning 6 Interviews 7 Third party report 8 Written tests 9 Case study

	• Access Cards & Badges • CCTVs 1.2.2.2 Technical controls • Firewalls • Data Encryption • Network Segmentation • Network monitoring and logging 1.2.2.3 Administrative controls • Access controls • Employee training on security awareness. • Screening and verification • Authentication mechanism 1.3 Computer network risk assessment reports 1.3.1 computer network risk assessment 1.3.2 reasons for conducting computer network risk assessment 1.3.3 Key components of a computer network risk assessment 1.3.4 How to conduct a computer network risk assessment 1.3.5 Tools and technologies for computer network risk assessment	

	1.3.5.1 Planning and preparation: 1.3.5.2 Threat analysis 1.3.5.3 Vulnerability scanners: 1.3.5.4 Risk management software 1.3.6 Best practices for network risk assessment 1.3.7 Documentation of the risk assessment report	
2. Monitor Computer Network Firewall activities	2.1 Computer Network Firewall 2.1.1 Introduction to computer network firewall 2.1.2 Importance of computer network firewall 2.1.3 Factors to consider in firewall monitoring 2.1.4 Types of firewall logs 2.1.4.1 Traffic 2.1.4.2 Event 2.1.4.3 System 2.1.4.4 Threat 2.1.5 Tools and techniques used in firewall monitoring 2.1.5.1 Packet filtering 2.1.5.2 Logging and reporting 2.1.5.3 Bandwidth management 2.1.5.4 URL Filtering 2.1.5.5 SolarWinds Network Performance Monitor (NPM) 2.1.6 Best practices for firewall management	➢ Practical test ➢ Project ➢ Portfolio of evidence ➢ Oral questioning ➢ Interviews ➢ Third party report ➢ Written tests ➢ Case study

	2.2 Firewall updates 2.2.1 Importance of regular firewall updates 2.2.2 procedure to updating firewall firmware and software 2.3 Computer network traffic. 2.3.1 Introduction to computer network traffic monitoring. 2.3.2 Benefits of computer network traffic monitoring 2.3.3 Monitoring of computer network traffic 2.3.4 Computer Network traffic monitoring tools 2.3.4.1 Wireshark 2.3.4.2 SolarWinds Network Performance Monitor (NPM) 2.3.4.3 Cisco Network Assistant (CNA)	
3. Perform fundamental Computer Network segmentation	3.1 IP addressing scheme. 3.1.1 IP addressing and subnetting 3.1.2 IP address fundamentals 3.1.2.1 Physical address. MAC address. 3.1.2.2 Logical address. IP address. 3.1.2.3 Hostname. 3.1.2.4 IPv4 vs. IPv6 3.1.2.5 Classful addressing 3.1.2.6 Static vs. Dynamic IP Addressing	● Practical test ● Project ● Portfolio of evidence ● Oral questioning ● Interviews ● Third party report ● Written tests ● Case study

	3.1.2.7 Public vs. Private IP Addresses 3.1.3 Steps in Designing an IP Addressing Scheme 3.2 Network segmentation 3.2.1 Introduction to network segmentation 3.2.1.1 Definition of network segmentation 3.2.1.2 Physical & logical segmentation 3.2.1.3 Importance of network segmentation 3.2.2 Types of network segmentation 3.2.2.1 IP based 3.2.2.2 VLANs 3.2.2.3 Subnetting 3.2.2.4 Firewalls 3.2.2.5 Physical segmentation 3.2.3 Tools and techniques for network segmentation 3.2.3.1 Firewalls, Routers, and Access Control Lists (ACLs) 3.2.3.2 Network Access Control (NAC) 3.2.4 Monitoring and Managing Network Segments 3.3 Network privileges. 3.3.1 Introduction to network privilege management 3.3.1.1 Definition of Network Privileges.	

	3.3.1.2 Roles of network privileges. 3.3.2 Types of Network Privileges: 3.3.2.1 Read, Write, Execute 3.3.3 Roles of Privilege Management in Network Security 3.3.3.1 Administrator privileges 3.3.3.2 User privileges 3.3.3.3 Read-only access 3.3.3.4 Remote access privileges 3.3.4 implementation of network access control 3.3.5 Understand Network Access Requirements 3.3.6 Develop Access Control Policies 3.3.7 Select a Network Access Control Solution	

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.

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Recommended Resources for 25 Trainees

S/No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Trainee: Item)
A	**Learning Materials**			

14.	Textbooks		13 pcs	2:1
15.	Installation manuals			
16.	Flip Charts			
17.	PowerPoint presentations	For trainer's use		
B	**Learning Facilities & infrastructure**			
18.	Lecture/theory room		1	25:1
19.	Laboratory		1	25:1
C	**Consumable materials**			
20.	Printing papers		1 ream	1:20
21.	Toners/Cartridges		2 pcs	13:1
22.	Assorted colour of whiteboard markers			
D	**Tools and Equipment**			
23.	Computers		25 pcs	1:1
24.	Projector		1 pc	25:1
25.	Flash drives		25 pairs	1:1
26.	External CD/DVD drives		13 pcs	2:1

BASIC ELECTRONICS

UNIT CODE: 0714 541 09A

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 managing electrical circuits, managing electronic components, applying semi-conductor theory, managing memory, applying number systems and binary coding and managing emerging trends in electronics

Summary of Learning Outcomes

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

Learning Outcomes, Content and Suggested Assessment Methods

Learning outcomes	Content	Suggested Assessment Methods
1. Identify electrical circuits	1.1 Electrical circuit identification 1.1.1 Definition of electrical circuit 1.1.2 Components of electrical circuit 1.2 Electrical quantities and their S.I units identification	• Practical exercises • Written • Observation • Oral

	1.2.1 Basic electrical quantities and their units 1.2.1.1 Emf in volts 1.2.1.2 Current in Amperes 1.2.1.3 Power in watts 1.2.1.4 Energy in joules 1.2.1.5 Resistance in ohms 1.3 Types of electrical circuits 1.3.1 AC – Alternating Current 1.3.2 DC – Direct Current	
2. Identify Electronic components	2.1 Identification of electronic components 2.1.1 Resistor 2.1.2 Capacitor 2.1.3 Diode 2.1.4 Inductor 2.2 Characteristic of electronic components. 2.3 Application of electronic components. 2.4 Characteristics of integrated circuit	• Practical exercises • Written • Observation • Oral
3. Apply semi-conductor theory	3.1 Explanation of semiconductor theory 3.2 Descriptions of structure of matter 3.3 Explanation of Electrons in conductors and semiconductors 3.4 Types of semiconductor materials 3.4.1 Silicon	• Practical exercises • Written • Observation • Oral

	3.4.2 Germanium 3.5 Explanation of P-type and N-type materials 3.6 Description of P-N junction diodes 3.6.1 Forward biasing 3.6.2 Reverse biasing 3.7 Types and operations of transistors 3.7.1 PNP type 3.7.2 NPN type 3.8 Application of Semiconductor theory	
4. Classify computer memory	4.1 Identification of computer memories 4.1.1 Definition of computer memory 4.1.2 Classification of computer memory 4.1.2.1 Primary memory 4.1.2.2 Secondary memory 4.1.3 Types of computer memories 4.1.3.1 RAM 4.1.3.2 ROM 4.1.3.3 DAM 4.2 Identification of Memory hierarchy speed 4.2.1 Registers 4.2.2 Cache memory 4.2.3 Main memory 4.2.4 Secondary storage 4.2.5 Tertiary storage	• Practical exercises • Written • Observation • Oral

	4.3 Identification of memory storage levels 4.3.1 Internal 4.3.2 Main 4.3.3 Online 4.3.4 Offline bulk 4.4 Classify computer memories as per the technology used 4.4.1 Semiconductor memory 4.4.2 Magnetic memory 4.4.3 Optical memory	
5. Apply logic gates	5.1 Identification of Logic gates 5.1.1 Definition of terms 5.1.2 Types of logic gates 5.1.2.1 AND Gate 5.1.2.2 OR Gate 5.1.2.3 NOT Gate 5.1.2.4 NAND Gate 5.1.2.5 NOR Gate 5.1.2.6 XOR Gate 5.1.2.7 XNOR Gate 5.2 Development of Logic circuits 5.3 Simplification of Logic circuits 5.3.1 Logic circuits Simplification Methods 5.3.1.1 Boolean Algebra 5.3.1.2 K-Maps 5.3.1.3 Quine-McCluskey Algorithm 5.3.1.4 Software and CAD Tools 5.4 Application of logic gates in electronic circuits	• Practical exercises • Written • Observation • Oral

6. Perform Boolean algebra operations	6.1 Identify key concepts in Boolean algebra 6.1.1 Boolean variables 6.1.2 Logical operations 6.1.3 Boolean expressions 6.1.4 Laws and rules of Boolean algebra 6.1.5 Truth tables 6.1.6 De Morgan's theorem 6.2 Demonstration of Boolean expressions 6.3 Performance of Basic Boolean operations 6.4 Methods of simplifying Boolean expressions 6.5 Illustration of Boolean Laws and Theorems 6.6 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**			
10.	Textbooks		13 pcs	2:1
11.	Installation manuals			

12.	Flip Charts			
13.	PowerPoint presentations	For trainer's use		
B	**Learning Facilities & infrastructure**			
14.	Lecture/theory room		1	25:1
15.	Laboratory		1	25:1
C	**Consumable materials**			
16.	Printing papers		1 ream	1:20
17.	Toners/Cartridges		2 pcs	13:1
18.	Assorted colour of whiteboard markers			
D	**Tools and Equipment**			
33.	Computers		25 pcs	1:1
34.	Projector		1 pc	25:1
35.	Signal testers		5 pcs	5:1
36.	Header checker		25 pcs	1:1
37.	Crimping tools		13 pcs	2:1
38.	Cable tester		5 pcs	5:1
39.	Punch Downs		5 pcs	5:1
40.	Switches		5pcs	5:1
41.	Repeaters		5pcs	5:1
42.	Routers/modem		5pcs	5:1
43.	Network tool kit		25 pcs	1:1
44.	Gateways		5pcs	5:1
45.	Packets of RJ45		300 pcs	1:10
46.	Fibre Modules (SFP)		5pcs	5:1
47.	UTP Ethernet Cable		300 meters	1:10
48.	Antistatic gloves		25 pairs	1:1
49.	Ohmmeter			
50.	Ammeter			
51.	Digital Multi meter			
52.	Power supplies			
53.	Circuits			
54.	Semiconductor materials			
55.	Conductors e.g., copper, gold, silver			
56.	Insulators			
57.	Screw Drivers			

58.	Resistors			
59.	Capacitors			
60.	Logic gates			
61.	Inductors			
62.	Transistors			
63.	Transformers batteries, power supplies			
64.	Conducting wires			

WORK ETHICS AND PRACTICES

UNIT CODE: 0417 551 10A

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: conduct self-management, promote ethical work practices and values, promote teamwork, manage workplace conflicts, maintain professional and personal development, apply problem-solving, and promote customer care.

Summary of Learning Outcomes

LEARNING OUTCOMES	DURATION (HOURS)
1. Apply self-management skills	10
2. Promote ethical practices and values	5
3. Promote teamwork	5
4. Maintain professional and personal development	5
5. Apply problem-solving skills	10
6. Promote customer care.	5
TOTAL	**40**

Learning Outcomes, Content, and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Apply self-management skills	1.1 Self-awareness 1.2 Formulating personal vision, mission, and goals 1.3 Healthy lifestyle practices 1.4 Strategies for overcoming work challenge	● Observation ● Written assessment ● Oral assessment ● Third party reports ● Portfolio of evidence ● Project

Learning Outcome	Content	Suggested Assessment Methods
	1.5 Emotional intelligence 1.6 Coping with Work Stress. 1.7 Assertiveness versus aggressiveness and passiveness 1.8 Developing and maintaining high self-esteem 1.9 Developing and maintaining positive self-image 1.10 Time management 1.11 Setting performance targets 1.12 Monitoring and evaluating performance targets	● Practical
2. Promote ethical work practices and values	2.1 Integrity 2.2 Core Values, ethics and beliefs 2.3 Patriotism 2.4 Professionalism 2.5 Organizational codes of conduct 2.6 Industry policies and procedures	● Observation ● Written assessment ● Oral assessment ● Third party reports ● Portfolio of evidence ● Project ● Practical
3. Promote Teamwork	3.1 Types of teams 3.2 Team building 3.3 Individual responsibilities in a team 3.4 Determination of team roles and objectives 3.5 Team parameters and relationships 3.6 Benefits of teamwork 3.7 Qualities of a team player 3.8 Leading a team	● Observation ● Written assessment ● Oral assessment ● Third party reports ● Portfolio of evidence ● Project ● Practical

Learning Outcome	Content	Suggested Assessment Methods
	3.9 Team performance and evaluation 3.10 Conflicts and conflict resolution 3.11 Gender and diversity mainstreaming 3.12 Developing Healthy workplace relationships 3.13 Adaptability and flexibility 3.14 Coaching and mentoring skills	
4. Maintain professional and personal development	4.1 Personal vs professional development and growth 4.2 Avenues for professional growth 4.3 Recognizing career advancement 4.4 Training and career opportunities 4.5 Assessing training needs 4.6 Mobilizing training resources 4.7 Licenses and certifications for professional growth and development 4.8 Pursuing personal and organizational goals 4.9 Managing work priorities and commitments 4.10 Dynamism and on-the-job learning	● Observation ● Written assessment ● Oral assessment ● Third party reports ● Portfolio of evidence ● Project ● Practical

Learning Outcome	Content	Suggested Assessment Methods
5. Apply Problem-solving skills	5.1 Causes of problems 5.2 Methods of solving problems 5.3 Problem-solving process 5.4 Decision making 5.5 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
6. Promote Customer Care	6.1 Identifying customer needs 6.2 Qualities of good customer service 6.3 Customer feedback methods 6.4 Resolving customer concerns 6.5 Customer outreach programs 6.6 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
	2. PowerPoint presentations	For trainer's use		
	3. Assorted colour of whiteboard markers	For trainer's use	2 packets	
	4. e-Didactics	For trainer's use		
	5. Flashcards			
	6. Flip charts			
	7. Whiteboard			
B	**Learning Facilities & infrastructure**			
	1. Lecture/theory room		1	25:1
C	**Consumable materials**			
	1. Printing Papers		1 ream	1:20
	2. Toners		2 pcs	13:1
	3. Internet connection			
D	**Tools and Equipment**			
	1. Projectors		1	25:1
	2. Printers		4	6:1
	3. Computers/Mobile Phones		25 pcs	1:1

MODULE V

UNIT CATEGORY	UNIT CODE	UNIT NAME	DURATION (Hours)	CREDIT FACTORS
COMMON	0541 551 11A	Discrete Mathematical Concepts	160	16.0
CORE	0612 551 12A	Computer System Administration	220	22.0
BASIC	0031 551 13A	Communication Skills	40	4.0
		Total	**420**	**42.0**

DISCRETE MATHEMATICAL CONCEPTS

UNIT CODE: 0541 551 11A

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
2. Perform matrix operations	26
3. Apply number system	26
4. Apply logic gates	30
5. Perform sequence and series operations	20
6. 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	1.1. Identify sets Characteristics 1.1.1. Definition 1.1.2. Order and Uniqueness 1.2. Methods of set representation 1.2.1. Roster Form	• Practical Activities • Project work • Demonstr

	1.2.2. Set Builder Form 1.3. Cardinality of a set. 1.3.1. Finite 1.3.2. Infinite 1.4. Types of sets 1.4.1. Finite set 1.4.2. Infinite set 1.4.3. Empty set 1.4.4. Subset 1.4.5. Universal set 1.5. Venn Diagrams 1.5.1. Drawing Venn diagrams 1.6. Set Operations 1.6.1. Union 1.6.2. Intersection 1.6.3. Difference 1.6.4. Complement	ation • Group Work • Observation • Portfolio of Evidence • Written tests
2. Perform matrix operations	2.1. Applying Matrix order 2.1.1. Dimension of matrix 2.1.2. Types of Matrices 2.1.2.1. Row matrix 2.1.2.2. Column matrix 2.1.2.3. Square matrix 2.1.2.4. Zero matrix 2.2. Matrix operations 2.2.1. Addition 2.2.2. Multiplication 2.2.3. Subtraction 2.3. Transpose of a matrix 2.3.1. Swapping rows and columns 2.4. Transpose operations	• Practical Activities • Project work • Demonstration • Group Work • Observation • Third Party report • Portfolio of Evidence

	2.4.1. Transpose 2.4.2. Sum 2.4.3. Product 2.5. Adjoint of a square matrix identification 2.6. Inverse of a square matrix identification. 2.6.1. Trace of a matrix application 2.6.2. Application of matrices 2.6.3. Computer Graphics 2.6.4. Statistics 2.6.5. Systems of Linear Equations	• Written tests
3. Apply number Systems	3.1. Number systems 3.1.1. Definition of terms 3.1.2. Absolute values 3.1.3. Place values 3.1.4. Types of number systems 3.1.4.1. Decimal 3.1.4.2. Binary 3.1.4.3. Octal 3.1.4.4. Hexadecimal 3.2. Base conversion 3.2.1. Decimal to Other number system 3.2.2. Other number systems to decimal 3.2.3. Binary to other number systems 3.2.4. Other number systems to	• Practical Activities • Project work • Demonstration • Group Work • Observation • Third Party report • Portfolio of Evidence • Written tests

	binary 3.3. Number systems arithmetic operations 3.3.1. Binary arithmetic 3.3.1.1. Addition, subtraction, multiplication and division 3.3.1.2. Ones and Twos complement 3.3.2. Octal arithmetic 3.3.2.1. Addition and subtraction 3.3.3. Hexadecimal arithmetic 3.3.3.1. Addition and subtraction 3.4. Binary codes 3.4.1. Binary coded decimal (BCD) 3.4.1.1. BCD operations 3.4.1.2. Addition and subtraction 3.4.2. ASCII 3.4.3. Gray Code 3.4.4. Excess-3	
4. Apply logic gates	4.1. Types of Logic gates 4.1.1. AND 4.1.2. OR 4.1.3. NOT 4.1.4. NAND 4.1.5. NOR 4.1.6. XOR	• Practical Activities • Project work • Demonstration • Group Work

	4.1.7. XNOR 4.2. Logic expressions 4.2.1. Logic circuit diagrams 4.2.2. Truth tables 4.3. Simplifying logic expressions 4.3.1. De-Morgan's theorems 4.3.2. Laws of Boolean algebra 4.3.2.1. Commutative 4.3.2.2. Associative 4.3.2.3. Distributive and more 4.3.2.4. Identity laws 4.3.2.5. Null laws 4.3.2.6. Complement laws 4.3.2.7. Commutative laws 4.3.3. Boolean expressions simplification. 4.3.4. Application of Boolean Algebra. 4.3.5. Application of Karnaugh's Maps	• Observation • Third Party report • Portfolio of Evidence • Written tests
5. Perform sequence and series operations	5.1. Key terms of sequences. 5.1.1. Term 5.1.2. Index 5.1.3. General term (nth term) 5.1.4. Finite sequence 5.1.5. Infinite sequence 5.2. Summation of a sequence. 5.2.1. Arithmetic sum 5.3. Arithmetic series 5.3.1. General form of an arithmetic sequence	• Practical Activities • Project work • Demonstration • Group Work • Observation • Third Party

	5.3.2. Sum of the first n terms 5.4. Geometric series 5.4.1. General form of a geometric sequence	report • Portfolio of Evidence • Written tests
6. Demonstrate graph theory	6.1. Key Graph terminologies 6.1.1. Node 6.1.2. Edge 6.1.3. Vertex 6.1.4. Adjacent 6.2. Types of graphs 6.2.1. Null 6.2.2. Simple 6.2.3. Multigraph 6.2.4. Directed graphs 6.2.5. Undirected graphs 6.3. Representation of graphs 6.3.1. Adjacency Matrix 6.3.2. Adjacency List 6.3.3. Incidence Matrix 6.4. Application of graphs 6.4.1. Computer Networks 6.4.2. Social Networks 6.4.3. Transport Networks 6.4.4. 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**			
1.	Internet connection	✓ 5mbps	1	1:1
2.	Flip charts	A1	1	1:25
3.	Textbooks	For reference	3	3:25
B	**Learning Facilities & infrastructure**			
4.	Theory Room	furnished with 25 Arm-chairs and a suitable trainer's table	1	1:25
C	**Consumable materials**			
5.	Printing papers	A4	5 Reams	1:25
6.	White board markers	Assorted colors	20	4:5
D	**Tools and Equipment**			
7.	External storage media	HDD / SSD / Flash	1	1:25
8.	Printer	Working printer	2	1:12
9.	1 Smart-board / Smart TV / Projector (with screen)	Where available	1	1:25
10.	Whiteboard/Chalkboard	4 X 8 Feet	1	1:25

COMPUTER SYSTEM ADMINISTRATION

UNIT CODE: 0612 551 12A

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
2. Configure Computer hardware and software	120
3. Upgrade Computer systems	60
TOTAL	**220**

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Manage Computer systems .	1.1 Computer systems incident response 1.1.1 Introduction to computer systems incident response management 1.1.2 Types of incident response reports □ Initial incident report □ Post incident review report □ Detailed incident analysis report 1.1.3 Computer systems incident management life cycle □ Incident identification. □ Incident categorization. □ Incident prioritization. □ Incident response. □ Incident closure.	● Practical test ● Project ● Portfolio of evidence ● Oral questioning ● Interviews ● Third party report ● Written tests ● Case study

	1.2 Computer system documentation and reporting compilation. 1.2.1 Meaning and importance of computer system documentation and reporting 1.2.2 Types of computer system documentation □ System documentation □ Technical documentation □ Installation guide documentation □ User documentation □ Maintenance documentation 1.2.3 Types of computer system reporting □ System performance report □ Error and event report □ Security reports □ Audit and compliance report □ Backup and recovery report 1.3 system user management 1.3.1 Importance of system user management 1.3.2 Types of system user accounts □ Administrator □ Guest □ Service □ Standard 1.3.3 Creating and managing system user accounts 1.3.4 Authentication and authorization □ Authentication methods(passwords, biometrics, Multi-Factor Authentication, Single Sign-On) □ Implementing authorization controls 1.3.5 User permissions and access control 1.4 Computer system resource allocation 1.4.1 Introduction to computer system resource allocation 1.4.2 Types of computer System resource □ Central Processing Unit □ Computer Memory □ Motherboard □ Device Drivers □ Computer Storage	

	- Computer I/O devices - Graphic Processing Unit - Network bandwidth 1.4.3 Factors to consider when allocating computer system resources - Type of resource - Task requirement - System performance and utilization - Scalability - Security and isolation 1.4.4 Techniques and concepts of computer system resource allocation - Process scheduling - Swapping - load balancing - disk partitioning 1.4.5 Computer system resource allocation environment - Cloud computing - Virtualization 1.4.6 Strategies for effective resource allocation - Quality of service - Dynamic resource - Power management 1.5 Computer system disaster recovery plan 1.5.1 Introduction to computer system disaster recovery plan 1.5.2 Type of computer systems disasters - Natural disasters - Cyber security incident - Human error and system failure 1.5.3 Risk assessment process for computer systems - Identification of potential risks - Evaluation of potential risks - Risk prioritization - Mitigation strategies 1.5.4 Computer system backup strategies 1.6 Computer system policy enforcement approaches. - Role-based access control - Automatic enforcement - Mediation/monitoring	

	□ Asymmetry	
2. Configure Computer hardware and software	2.1 Computer hardware and software configuration 2.1.1 Introduction to Computer hardware and software configuration □ Basic concepts and terminologies □ Importance of proper configuration □ Overview of hardware and software configuration 2.1.2 Understanding Systems requirements 2.1.3 Importance of system requirements 2.1.4 Types of system requirements ➢ Hardware requirement ➢ Software requirement ➢ connectivity requirement 2.1.5 Determining system requirements 2.2 Tools and workspace Preparation 2.2.1 Proper user of tools 2.2.2 Hardware tools □ ESD tools □ Hand tools □ Cleaning tools □ Diagnostic tools □ Cable tester □ Crimping tool □ Stripper □ Fiber Splicer 2.2.3 Software tools □ Disk management tools □ Protection software tools □ Diagnostic software tools 2.2.4 Organizational tools 2.2.5 Reference tools ➢ Personal reference tool ➢ Internet reference tool ➢ Standard and procedures 2.3 Software installation and configuration □ Operating software installation and setup □ Installing and configuring drivers □ Setting up virtual machine (Virtual|Box or VMware)	● Practical test ● Project ● Portfolio of evidence ● Oral questioning ● Interviews ● Third party report ● Written tests ● Case study

	□ Managing and optimizing virtual environments □ Application software installation □ Managing software updates and patches 2.3.1 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 2.4 System functionality testing 2.4.1 Introduction to Network 2.4.2 Testing Methodologies 2.4.3 Performance Metrics 2.4.4 Troubleshooting and Debugging 2.4.5 Security Testing 2.4.6 Documentation and Reporting 2.5 Introduction to data migration 2.5.1 Data migration strategies □ Bing bang □ Phased data migration strategies 2.5.2 Planning for data migration 2.5.3 Challenges to data migration 2.5.4 Data migration tools and techniques 2.5.5 Data security compliance during migration 2.6 Systems backup and recovery 2.6.1 Developing a backup strategy 2.6.2 Configuring backup software and hardware 2.6.3 Testing and verifying backups 2.6.4 Recovery planning	
3. Upgrade Computer systems	3.1 computer system updates and upgrades 3.1.1 Introduction to computer system updates and upgrades 3.1.2 Types of software upgrades and updates	● Practical test ● Project ● Portfolio of evidence

	- Functionality expansions upgrades - System integration upgrades - Security features upgrade - Software version upgrade 3.2 Categories of Computer systems for update and upgrade 3.2.1 Types of hardware upgrades and updates - RAM upgrades - Storage upgrades - Processor upgrades - motherboard upgrades - NIC upgrades 3.3 Performing computer system updates and upgrades 3.3.1 Computer system hardware and software updates and upgrades process 3.3.2 Maintaining upgrades and updates documentation 3.4 Creating and updating upgrades and updates reports 3.4.1 Best practices for documentation	● 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**			
1.	Textbooks		13 pcs	2:1
2.	Installation manuals			
3.	Flip Charts			

4.	PowerPoint presentations	For trainer's use		
B	**Learning Facilities & infrastructure**			
5.	Lecture/theory room		1	25:1
6.	Laboratory		1	25:1
C	**Consumable materials**			
7.	Printing papers		1 ream	1:20
8.	Toners/Cartridges		2 pcs	13:1
9.	Assorted colour of whiteboard markers			
D	**Tools and Equipment**			
10.	Computers		25 pcs	1:1
11.	Projector		1 pc	25:1
12.	Flash drives		25 pairs	1:1
13.	External CD/DVD drives		13 pcs	2:1

COMMUNICATION SKILLS

UNIT CODE: 0031 551 11A

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
2. Apply written communication skills.	12
3. Apply non-verbal skills.	4
4. Apply oral communication skills.	4
5. Apply group communication skills.	10
TOTAL	**40**

Learning Outcomes, Content, and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Apply communication channels	1.1 Communication process 1.1.1 Principles of effective communication 1.2 Channels/medium/modes of communication 1.2.1 Factors to consider when selecting a channel of communication	● Oral questions ● Written assessment ● Observation ● Portfolio of Evidence ● Practical assessment ● Third party report

Learning Outcome	Content	Suggested Assessment Methods
	1.2.2 Barriers to effective communication 1.3 Flow/patterns of communication 1.3.1 Sources of information 1.3.2 Organizational policies	
2. Apply written communication skills	2.1 Types of written communication 2.2 Elements of communication 2.3 Organization requirements for written communication	● Oral assessment ● Written assessment ● Observation ● Portfolio of Evidence ● Practical assessment ● Third party report
3. Apply non-verbal communication skills	3.1 Utilize body language and gestures 3.2 Apply body posture 3.3 Apply workplace dressing code	● Oral assessment ● Written assessment ● Observation ● Portfolio of Evidence ● Practical assessment ● Third party report
4. Apply oral communication skills	4.1 Types of oral communication pathways 4.2 Effective questioning techniques 4.3 Workplace etiquette 4.4 Active listening	● Oral assessment ● Written assessment ● Observation ● Portfolio of Evidence ● Practical assessment ● Third party report
5. Apply group discussion skills	5.1 Establishing rapport 5.2 Facilitating resolution of issues 5.3 Developing action plans 5.4 Group organization techniques 5.5 Turn-taking techniques	● Oral assessment ● Written assessment ● Observation ● Portfolio of Evidence ● Practical assessment

Learning Outcome	Content	Suggested Assessment Methods
	5.6 Conflict resolution techniques 5.7 Team-work	

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			
1.	Textbooks		5 pcs	5:1
2.	PowerPoint presentations	For trainer's use		
3.	Assorted colour of whiteboard markers	For trainer's use	2 packets	
4.	e-Didactics	For trainer's use		
5.	Flashcards			
6.	Flip charts			
7.	Whiteboard			
B	Learning Facilities & infrastructure			
8.	Lecture/theory room		1	25:1
C	Consumable materials			
9.	Printing Papers		1 ream	1:20

10.	Toners		2 pcs	13:1
11.	Internet			
D	Tools and Equipment			
12.	Projectors		1	25:1
13.	Printers		4	6:1
14.	Computers/Smartphones		25 pcs	1:1

MODULE VI

UNIT CATEGORY	UNIT CODE	UNIT NAME	DURATION (Hours)	CREDIT FACTORS
CORE	0732 551 14A	Database Administration	220	22.0
CORE	0732 551 15A	System Virtualization	220	22.0
BASIC	0732 551 16A	Entrepreneurial Skills	40	4.0
		Total	**480**	**48.0**

DATABASE ADMINISTRATION

UNIT CODE: 0612 551 14A

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
2. Design Database	160
3. Backup Database	30
TOTAL	**220**

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Install Database .	1.1 Database software installation and configuration 1.1.1 Introduction to database software installation and configuration 1.1.2 Meaning of database software installation and configuration 1.1.3 Advantages of database software 1.1.4 Application of database software 1.1.5 Types of database software 1.1.5.1 Access 1.1.5.2 SQL 1.1.5.3 MySQL 1.1.5.4 Oracle 1.1.5.5 PostgreSQL 1.1.5.6 MongoDB 1.1.5.7 Redis	● Practical test ● Project ● Portfolio of evidence ● Oral questioning ● Interviews ● Third party report ● Written tests ● Case study

	1.1.5.8 MariaDB 1.1.6 Database software installation process 1.1.7 database software configuration process 1.1.8 best practices in database configuration 1.2 Database resource allocation 1.2.1 Introduction to database systems 1.2.2 Database system resource allocation 1.2.2.1 CPU allocation 1.2.2.2 Memory allocation 1.2.2.3 Disk storage allocation 1.2.2.4 Network bandwidth allocation 1.3 Performing database testing 1.3.1 Introduction to database testing 1.3.1.1 Microsoft SQL Server 1.3.1.2 DTM Data generator 1.3.1.3 HammerDB 1.3.2 Types of database testing 1.3.2.1 Functional 1.3.2.2 Data integrity 1.3.2.3 Performance 1.3.2.4 Stress and load 1.3.2.5 security 1.3.3 Database testing techniques 1.3.3.1 White-box 1.3.3.2 Black-box 1.3.3.3 Query 1.3.3.4 Data validation 1.3.4 Database testing tools 1.3.4.1 Apache Jmeter 1.3.4.2 DBFit 1.3.4.3 SQLTest 1.4 Database storage mechanism 1.4.1 Understanding storage architecture 1.4.2 Database Indexing 1.4.3 Partitioning and shading 1.4.4 Database retrieval and performance optimization 1.4.4.1 Creating database queries 1.4.4.2 Query optimization techniques 1.4.4.3 Indexing strategies for efficient retrieval 1.4.4.4 Caching mechanisms 1.5 Database performance monitoring and optimization	

	1.5.1 Setting up and configuring database monitoring tools (Solarwinds, PRTG, Nagios, NewRelic) 1.6 Data Migration 1.6.1 Collecting and visualizing performance data 1.7 Database installation Troubleshooting	
2. Design Database	2.1 Database Structure 2.1.1 Introduction to database structures 2.1.2 Data modelling concepts 2.1.2.1 Conceptualization 2.1.2.2 Entity-Relationship (ER) diagrams 2.1.2.3 Normalization and Demoralization 2.1.3 Database approaches 2.1.3.1 Flat table schema 2.1.3.2 Normalized schema 2.1.3.3 Star schema 2.1.3.4 Hierarchical schema 2.1.3.5 Document database schema 2.2 Database security 2.2.1 Fundamental principles of database security 2.2.1.1 Confidentiality 2.2.1.2 Integrity 2.2.1.3 Availability 2.2.1.4 Accessibility 2.2.1.5 Reliability 2.2.2 Implementing database security measures 2.2.2.1 User authentication and access control 2.2.2.2 Encryption 2.2.2.3 Password 2.2.2.4 Database auditing and monitoring 2.2.2.5 Software updates and patching 2.2.2.6 Database backup and recovery. 2.3 Database storage 2.3.1 Meaning database storage 2.3.2 Types of database storage 2.3.2.1 Internal 2.3.2.2 external 2.3.3 Storage optimization strategies 2.3.3.1 RAID	• Practical test • Project • Portfolio of evidence • Oral questioning • Interviews • Third party report • Written tests • Case study

	2.3.4 I/O considerations	
3. Backup Database	3.1 Database Backup 3.1.1 Types of database backup 3.1.1.1 Full backup 3.1.1.2 Incremental backup 3.1.1.3 Differential backup 3.1.2 Backup location and storage 3.1.3 Backup scheduling 3.1.3.1 Automated backups 3.1.3.2 Time window considerations 3.1.4 Backup tools 3.1.4.1 Native database tools 3.1.4.2 Third party tools 3.2 Backup storage and management 3.2.1 Backup storage strategy 3.2.2 Backup policy 3.2.3 Database storage best practices 3.2.3.1 Use compression 3.2.3.2 Database Storage monitoring and maintenance 3.3 Database Backup security 3.3.1 Testing backup and restore processes 3.3.2 Disaster recovery and redundancy 3.3.3 Database storage setup requirement 3.3.4 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**			
1.	Textbooks		13 pcs	2:1
2.	Installation manuals			

3.	Flip Charts			
4.	PowerPoint presentations	For trainer's use		
B	**Learning Facilities & infrastructure**			
5.	Lecture/theory room		1	25:1
6.	Laboratory		1	25:1
C	**Consumable materials**			
7.	Printing papers		1 ream	1:20
8.	Toners/Cartridges		2 pcs	13:1
9.	Assorted colour of whiteboard markers			
D	**Tools and Equipment**			
10.	Computers		25 pcs	1:1
11.	Projector		1 pc	25:1
12.	Flash drives		25 pairs	1:1
13.	External CD/DVD drives		13 pcs	2:1

SYSTEM VIRTUALIZATION

UNIT CODE: 0612 551 15A

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
2. Setup virtual Machines	25
3. Allocate Virtual Resources	25
4. Install Virtual machine operating systems	45
5. 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.	1.1. Virtual System Machine Monitor 1.1.1 Introduction to software Based Virtualization 1.1.2 benefits of virtualization 1.1.3 Types of virtualization 1.1.3.1 Hardware 1.1.3.2 Software 1.1.3.3 network and storage 1.1.4 Types of hypervisors 1.1.4.1 Virtualbox 1.1.4.2 VMware	● Practical test ● Project ● Portfolio of evidence ● Oral questioning ● Interviews ● Third party report ● Written tests ● Case study

	1.1.4.3 Proxmox 1.1.4.4 Openvx 1.1.4.5 Type 1: bare-metal 1.1.4.6 Type 2: hosted 1.1.5 Setting up hypervisors 1.2. Software containerization 1.2.1 Definition of containerization 1.2.2 Benefits of containerization 1.2.2.1 Portability 1.2.2.2 Scalability 1.2.2.3 Fault torelance 1.2.2.4 Agility 1.2.3 Application areas of containerization 1.2.3.1 Cloud migration 1.2.3.2 IoT devices 1.2.3.3 Adoption of micro-service architecture 1.2.4 Types of container technology 1.2.4.1 Kubernetes 1.2.4.2 Docker 1.2.4.3 Docker swarm 1.2.4.4 Apache mesos 1.2.4.5 Linux 1.3. Virtual Machine Setup (VMs) 1.3.1 Creating and managing virtual machines 1.3.2 Allocating resources (CPU, memory, storage and network) to VMs 1.3.3 VM migration 1.3.4 Backup and restoration of VM 1.3.5 Configuring Virtual networks 1.3.6 Security consideration for hypervisors and VMs	
2. Setup virtual Machines	2.1 Virtual Machines Configuration 2.1.1 Installing and configuring type 1 and type 2 hypervisors 2.1.2 Creating virtual machines 2.1.3 Introduction to Docker platform 2.2 Virtual Machine resource allocation 2.3 Dockers configuration 2.3.1 Setting up and configuring Docker 2.3.2 Introduction to container orchestration	● Practical test ● Project ● Portfolio of evidence ● Oral questioning ● Interviews ● Third party report ● Written tests ● Case study

3. Allocate Virtual resources	3.1 Virtual Machine Resources 3.1.1 Key concepts 3.1.2 Types of Virtual Machine Resources 3.1.2.1 RAM 3.1.2.2 Storage space 3.2 Docker Images 3.2.1 introduction and importance of Docker images 3.2.2 Components of Docker images 3.2.2.1 Layers 3.2.2.2 Base image 3.2.2.3 Dockerfile 3.2.2.4 Image ID 3.2.2.5 tags 3.2.3 Container orchestration tools 3.3 Docker Commands 3.3.1 Introduction to Docker Commands 3.3.2 Docker image sub commands 3.3.2.1 Docker build 3.3.2.2 Docker pull 3.3.2.3 Docker rm 3.3.2.4 Docker commit 3.3.3 Docker image structure 3.3.4 Creation of docker image	● Practical test ● Project ● Portfolio of evidence ● Oral questioning ● Interviews ● Third party report ● Written tests ● Case study ● Written tests ● Case study
4. Install Virtual machine Operating systems	4.1 Virtual Machine – Operating System 4.1.1 Introduction to Virtual machine operating systems 4.1.2 Types of virtual machine operating system 4.1.2.1 Windows 4.1.2.2 Linux 4.1.2.3 MAC 4.1.3 Installation of virtual machine operating system process 4.2 Virtual Machine Parameters 4.2.1 Introduction to virtual machine parameters specifications 4.2.2 Virtual machines configuration parameters 4.2.2.1 Name and folder 4.2.2.2 Host /cluster 4.2.2.3 Resource pool 4.2.2.4 Data store 4.2.2.5 Hardware machine version 4.2.2.6 Guest operating system	● Practical test ● Project ● Portfolio of evidence ● Oral questioning ● Interviews ● Third party report ● Written tests ● Case study

	4.2.2.7 Memory 4.2.2.8 CPUs 4.2.2.9 Network 4.3 Virtual Network Configuration 4.3.1 Introduction to Virtual network configuration 4.3.2 Components of virtual networking 4.3.2.1 Virtual network Interface Card 4.3.2.2 Virtual switch 4.3.2.3 Virtual router 4.3.2.4 Virtual segmentation 4.3.3 Types of virtual networking 4.3.3.1 Host Only Network 4.3.3.2 Network address translation Network 4.3.3.3 Internal network 4.3.3.4 Bridged Network 4.3.4 Virtual networking in cloud environment 4.3.4.1 AWS 4.3.4.2 Vnet 4.3.4.3 Azure 4.3.4.4 Google cloud 4.3.5 Benefits of virtual networking 4.3.6 Challenges of virtual networking	
5. Manage virtual Storage	5.1 Introduction to virtual storage 5.1.1 Types of virtual storage 5.1.1.1 Block storage 5.1.1.2 Software define storage(SDS) 5.1.2 Storage virtualisation techniques 5.1.2.1 Host based 5.1.2.2 Array based 5.1.2.3 Network based 5.2 Virtual Disks 5.2.1 Introduction to virtual disk 5.2.2 Types of virtual disks 5.2.2.1 Thick Provisioning 5.2.2.2 Thin provisioning 5.2.3 Virtual disk management techniques 5.2.3.1 Resize virtual disks 5.2.3.2 Snapshots and storage 5.2.3.3 Storage allocation strategies 5.2.3.4 Disk defragmentation 5.2.4 Storage technologies in virtual environments 5.2.4.1 Storage area networks 5.2.4.2 Network attached storage	● Practical test ● Project ● Portfolio of evidence ● Oral questioning ● Interviews ● Third party report ● Written tests ● Case study

	5.2.4.3 Software defined storage 5.2.5 Backup and disaster recovery for virtual disks 5.2.5.1 Regular backups 5.2.5.2 Disaster recovery 5.2.6 Storage best practices for virtual disks 5.2.6.1 Regular monitoring 5.2.6.2 Optimize storage tools 5.3 Cloud Storage Configuration 5.3.1 Introduction to cloud storage configuration for remote access 5.3.2 Types of cloud storage configurations 5.3.3 Setting up remote access to cloud storage 5.3.4 Access control and authentication 5.3.5 Configuring cloud storage for file sharing 5.3.6 Using virtual private networks for cloud storage access 5.3.7 Configuring cloud storage access for remote access 5.3.7.1 Remote desktop solutions 5.3.7.2 Mobile device access 5.3.7.3 Remote video and media access 5.3.8 Compliance and data governance for remote access to cloud storage 5.3.9 Monitoring and auditing remote access to cloud storage	

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**			

1.	Textbooks		13 pcs	2:1
2.	Installation manuals			
3.	Flip Charts			
4.	PowerPoint presentations	For trainer's use		
B	**Learning Facilities & infrastructure**			
5.	Lecture/theory room		1	25:1
6.	Laboratory		1	25:1
C	**Consumable materials**			
7.	Printing papers		1 ream	1:20
8.	Toners/Cartridges		2 pcs	13:1
9.	Assorted colour of whiteboard markers			
D	**Tools and Equipment**			
10.	Computers		25 pcs	1:1
11.	Projector		1 pc	25:1
12.	Flash drives		25 pairs	1:1
13.	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
2. Apply the entrepreneurial concept	4
3. Identify entrepreneurship opportunities	6
4. Apply business legal aspects	6
5. Innovate Business Strategies	6
6. Develop business plan	12
TOTAL	**40**

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Apply financial literacy	1.1 Personal finance management 1.2 Balancing between needs and wants 1.3 Budget Preparation 1.4 Saving management 1.5 Factors to consider when deciding where to save 1.6 Debt management 1.7 Factors to consider before taking a loan 1.8 Investment decisions	• Observation • Project • Written assessment • Oral assessment • Third party report • Interviews

Learning Outcome	Content	Suggested Assessment Methods
	1.9 Types of investments 1.10 Factors to consider when investing money 1.11 Insurance services 1.12 insurance products available in the market 1.13 Insurable risks	
2.Apply entrepreneurial concept	2.1 Difference between Entrepreneurs and Business persons 2.2 Types of entrepreneurs 2.3 Ways of becoming an entrepreneur 2.4 Characteristics of Entrepreneurs 2.5 salaried employment and self-employment 2.6 Requirements for entry into self-employment 2.7 Roles of an Entrepreneur in an enterprise 2.8 Contributions of Entrepreneurship	• Observation • Project • Written assessment • Oral assessment • Third party report
3.Identify entrepreneurship opportunities	3.1 Sources of business ideas 3.2 Factors to consider when evaluating business opportunity 3.3 Business life cycle	• Observation • Project • Written assessment • Oral assessment • Third party report
4.Apply business legal aspects	4.1 Forms of business ownership 4.2 Business registration and licensing processing 4.3 Types of contracts and agreements 4.4 Employment laws 4.5 Taxation laws	• Observation • Project • Written assessment • Oral assessment • Third party report
5.Innovate business Strategies	5.1 Creativity in business 5.2 Innovative business strategies 5.3 Entrepreneurial Linkages 5.4 ICT in business growth and development	• Observation • Project • Written assessment • Oral assessment • Third party report
6.Develop Business Plan	6.1 Business description	• Observation

Learning Outcome	Content	Suggested Assessment Methods
	6.2 Marketing plan 6.3 Organizational/Management plan 6.4 Production/operation plan 6.5 Financial plan 6.6 Executive summary 6.7 Business plan presentation 6.8 Business idea incubation	• 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