	Curriculum Document	
Curriculum Code	**Curriculum Title**	
251201003	Occupational Certificate: Internet-of Things-Developer	
	Name	**Email**	**Phone**	**Logo**
Development Quality Partner	MICT SETA	matome.madibana @mict.org.za	011-2072600	

———————————————   ———————————————

Learner QDF Signature   **Date**

———————————————   ———————————————

QDF Signature   **Date**

———————————————   ———————————————

DQP Representative Signature   **Date**

Table of content

SECTION 1: CURRICULUM SUMMARY

1. Occupational Information

1.1 Associated Occupation

251201: Software Developer

1.2 Occupation or Specialisation Addressed by this Curriculum

251201-003: Internet of Things Developer

1.3 Alternative Titles used by Industry

- Internet of Things Deployment Specialist

2. Curriculum Information

2.1 Curriculum Structure

This qualification is made up of the following compulsory Knowledge and Practical Skills Modules:

Knowledge Modules:

- 251201003-KM-01, Introduction to Internet of Things, NQF Level 4, Credits 4

- 251201003-KM-02, Computers, Devices and Computing Systems, NQF Level 4, Credits 6

- 251201003-KM-03, Building Blocks of Internet of Things, NQF Level 4, Credits 8

- 251201003-KM-04, Internet of Things Design and Development Considerations, NQF Level 4, Credits 8

- 251201003-KM-05, Data, Databases and Visualisation, NQF Level 4, Credits 4

- 251201003-KM-06, 4IR and Future Skills, NQF Level 4, Credits 4

- 251201003-KM-07, Design Thinking Principles for Innovation, NQF Level 4, Credits 1

- 251201003-KM-08, Basic electronic principles, NQF Level 3, Credits 4

Total number of credits for Knowledge Modules: 39

Practical Skills Modules:

- 251201003-PM-01, Apply Basic Scriptwriting for Internet of Things Toolsets, NQF Level 4, Credits 4

- 251201003-PM-02, Access, Analyse and Visualise Structured Data using Spreadsheets, NQF Level 4, Credits 4

- 251201003-PM-03, Implement the Internet of Things Solution Infrastructure and Deploy Edge Devices, NQF Level 4, Credits 10

- 251201003-PM-04, Provision and Manage Devices, NQF Level 4, Credits 10

- 251201003-PM-05, Process and Manage Data in an Internet of Things Solution, NQF Level 4, Credits 8

- 251201003-PM-06, Monitor, Troubleshoot and Optimise Ineternet of Things Solutions, NQF Level 4, Credits 8

- 251201003-PM-07, Implement Security Measures for Internet of Things Solution, NQF Level 4, Credits 10

- 251201003-PM-08, Participate in a Design Thinking for Innovation Workshop, NQF Level 4, Credits 3

- 251201003-PM-09, Function Ethically and Effectively in the Workplace, NQF Level 4, Credits 3

Total number of credits for Practical Skills Modules: 60

This qualification also requires the following Work Experience Modules:

- 251201003-WM-01, Internet of Things Solution Deployment Processes, NQF Level 4, Credits 15

- 251201003-WM-02, Data Collecting, Aggregating, Disseminating And Storing Processes, NQF Level 4, Credits 15

- 251201003-WM-03, Data Integration Systems and Processes, NQF Level 4, Credits 12

Total number of credits for Work Experience Modules: 42

2.2 Entry Requirements

NQF 3

3. Assessment Quality Partner Information

Name of body: MICT Seta

Address of body: 19 Richards Dr, Halfway House, Midrand, 1685

Contact person name: Gugu Sema

Contact person work telephone number: 011-2072600

4. Part Qualification Curriculum Structure

None

SECTION 2: OCCUPATIONAL PROFILE

1. Occupational Purpose

An Internet-of-Things Developer coordinates all components of an Internet-of-Things (IoT) solution that includes sensors, devices, actuators, networks and other infrastructure to aggregate and disseminate data, store the data on the cloud and make it available to the data scientist for decision making, thus being responsible for the full cycle from data collection to data delivery

2. Occupational Tasks

- Deploy an IoT solution by connecting sensors, devices and things to a wired or wireless network (NQF Level 4)

- Accurately collect, aggregate, disseminate and store large amounts of unstructured and structured data generated by these devices (NQF Level 4)

- Integrate collected data with the existing systems such as enterprise resource planning (ERP) of an organisation for consumption and use (NQF Level 4)

3. Occupational Task Details

3.1. Deploy an IoT solution by connecting sensors, devices and things to a wired or wireless network (NQF Level 4)

Unique Product or Service:

- An IoT Solution

Occupational Responsibilities:

- Provision and Manage Devices

Occupational Contexts:

- IoT Solution Deployment Processes

3.2. Accurately collect, aggregate, disseminate and store large amounts of unstructured and structured data generated by these devices (NQF Level 4)

Unique Product or Service:

- Data Collection

Occupational Responsibilities:

- Access, Analyse and Visualise Structured Data using Spreadsheets

Occupational Contexts:

- Data Collecting, Aggregating, Disseminating And Storing Processes

3.3. Integrate collected data with the existing systems such as enterprise resource planning (ERP) of an organisation for consumption and use (NQF Level 4)

Unique Product or Service:

- IoT solution integrating

Occupational Responsibilities:

- Process and Manage Data in an IoT Solution

Occupational Contexts:

- Data Integration Systems and Processes

SECTION 3: CURRICULUM COMPONENT SPECIFICATIONS

SECTION 3A: KNOWLEDGE MODULE SPECIFICATIONS

List of Knowledge Modules for which Specifications are included

Knowledge	251201-003-00-KM-01	Introduction to Internet of Things	4	4
Knowledge	251201-003-00-KM-02	Computers, Devices and Computing Systems	4	6
Knowledge	251201-003-00-KM-03	Building Blocks of Internet of Things	4	8
Knowledge	251201-003-00-KM-04	Internet of Things Design and Development Considerations	4	8
Knowledge	251201-003-00-KM-05	Data, Databases and Visualisation	4	4
Knowledge	251201-003-00-KM-06	4IR and Future Skills	4	4
Knowledge	251201-003-00-KM-07	Design Thinking Principles for Innovation	4	1
Knowledge	251201-003-00-KM-08	Basic Electronic Principles	3	4

1. 251201-003-00-KM-01, Introduction to Internet of Things, NQF Level 4, Credits 4

1.1 Purpose of the Knowledge Module

The main focus of the learning in this knowledge module is to build an understanding of the impact of IoT on current workplaces and work processes.

The learning will enable learners to demonstrate an understanding of:

- KM-01-KT01 : Basics of telemetry **10%**
- KM-01-KT02 : History **10%**
- KM-01-KT03 : Internet of Things ecosystems and Drivers **10%**
- KM-01-KT04 : Characteristics of the Internet of Things ecosystems **10%**
- KM-01-KT05 : Trends and future developments **15%**
- KM-01-KT06 : Criticism, problems and controversies **10%**
- KM-01-KT07 : Internet of Things impact **20%**
- KM-01-KT08 : Internet of Things adoption barriers **5%**
- KM-01-KT09 : Security and governance **5%**
- KM-01-KT10 : Security considerations **5%**

1.2 Guidelines for Topics

1.2.1 KM-01-KT01 : Basics of telemetry 10%

Topic elements to be covered include:

- KT0101 Introduction to Internet of Things Telemetry:
  - Concept and Principles
  - Definitions and terminology
  - Applications
  - Types
- KT0102 The telemetry scenario
- KT0103 Things and devices
- KT0104 Device Security
- KT0105 Message Broker and Internet of Things Device Registry
- KT0106 Rules engine overview
- KT0107 Presenting the Data:
  - Internet of Things Analytics
  - Visualizing the Data
  - Establish Communication with the device
- KT0108 Best Practices for Telemetry

Internal Assessment Criteria and Weight

- IAC0101 The process of recording and transmitting the readings of an instrument is described
- IAC0102 **Telemetry** is defined as the automatic measurement and transmission of data at a distance by radio, cellular or other means

(Weight 10%)

1.2.2 KM-01-KT02 : History 10%

Topic elements to be covered include:

- KT0201 Origin
- KT0202 Evolution

- KT0203   Potential growth
- KT0204   Contribution to the economy
- KT0205   Connection with other fields
- KT0206   International trends in Internet of Things
- KT0207   Career options in Internet of Things

Internal Assessment Criteria and Weight

- IAC0201   The history and evolution of Internet of Things and the Hype Cycle of emerging technologies are explained

(Weight 10%)

1.2.3   KM-01-KT03   :   Internet of Things ecosystems and Drivers   10%
Topic elements to be covered include:

- KT0301   Definition
- KT0302   Purpose
  - Drive efficiency
  - Improve quality of life
- KT0305   Co-existing Internet of Things ecosystems
- KT0306   Politics and civic engagement
- KT0307   Government regulation on Internet of Things
- KT0308   Cyber-Physical Systems and differences among IoE, M2M and Internet of Things
- KT0309   The role of social media and mobility in Internet of Things
- KT0310   The role of Big Data and analytics in Internet of Things
- KT0311   The role of Cloud Computing in Internet of Things

Internal Assessment Criteria and Weight

- IAC0301   Characteristics and lifecycle of Cyber-Physical System (CPS) are stated

- IAC0302   A distinction is made between Internet of Things, Machine-to-Machine (M2M), and Internet of Everything (IoE)

- IAC0303   A relation to the enabling technologies that support Internet of Things and their challenges is formed

- IAC0304   Recall the roles of social media and mobility in Internet of Things are recalled

- IAC0305   The roles of big data and analytics in Internet of Things are described

- IAC0306   The role of cloud computing in Internet of Things is stated

- IAC0307   Best practices for the selection of the right cloud model, analytics platform and mobile devices are related to

(Weight 10%)

1.2.4   KM-01-KT04   :   Characteristics of the Internet of Things ecosystems   10%
Topic elements to be covered include:

- KT0401   Characteristics:

- Complex and range of variety
- Evolve and adapt
- Dynamic – constantly shifting
- Fragmented
- Continuous improvement
- Complete connectivity
- Digital transformation
  - KT0402   Intelligence
  - KT0403   Complexity
  - KT0404   Size considerations
  - KT0405   Space (storage) considerations
  - KT0406   A solution to "basket of remotes"

Internal Assessment Criteria and Weight

- IAC0401   Characteristics of the Internet of Things ecosystems are interrogated to determine opportunities and constraints

Weight 10%)

1.2.5   KM-01-KT05   :   Trends and future developments   15%
Topic elements to be covered include:

- KT0501   Limitless applications
- KT0502   Trends and future developments
- KT0503   Business expectations
- KT0504   Convergence of business goals and technology
- KT0505   Human:
  - Internet of Things engineers, architects, developers
  - End-user and end-user interfaces
  - Business goals
  - Making sense of data
- KT0506   Fastest-growing areas for Internet of Things:
  - Smart homes
  - Retail
  - Electronic health care
  - Logistics
  - Manufacturing

Internal Assessment Criteria and Weight

- IAC0501   Trends and future developments are interrogated to determine opportunities and constraints

(Weight 15%)

1.2.6   KM-01-KT06   :   Criticism, problems and controversies   10%
Topic elements to be covered include:

- KT0601   Platform fragmentation
- KT0602   Privacy, autonomy and control
- KT0603   Data storage and analytics and Big Data
- KT0604   Security
- KT0605   Safety
- KT0606   Design
- KT0607   Environmental sustainability impact
- KT0608   Intentional obsolescence of devices (case study – precedence – not giving value for money)
- KT0609   Disruption and innovation
- KT0610   Confusing terminology

Internal Assessment Criteria and Weight

- IAC0601   Criticism, problems and controversies are evaluated to find opportunities to mitigate

(Weight 10%)

1.2.7   KM-01-KT07   :   Internet of Things impact   20%

Topic elements to be covered include:

- KT0701   Internet of Things revolution
- KT0702   Drivers of Internet of Things
- KT0703   Benefits of a connected world
- KT0704   Internet of Things in business: opportunities, benefits and challenges
- KT0705   Internet of Things monetisation
- KT0706   Consumer applications:
    - Smart home
    - Elder care
- KT0707   Organisational applications:
    - Medical and healthcare
    - Transportation
    - V2X communications
    - Building and home automation
- KT0708   Industrial applications:
    - Predictive maintenance
    - Manufacturing
    - Agriculture
- KT0709   Infrastructure applications:
    - Metropolitan scale deployments
    - Energy management
    - Environmental monitoring
- KT0710   Military applications:
    - Internet of Battlefield Things
    - Ocean of Things
- KT0711   Product digitisation
- KT0712   Theory integration – where does Internet of Things fit into the picture

Internal Assessment Criteria and Weight

- IAC0701   List the key drivers for the evolution of Internet of Things and relate to the significance of drivers

- IAC0702   Benefits and capabilities of a connected world are related to

- IAC0703   Internet of Things opportunities for business applications are identified

- IAC0704   Internet of Things opportunities for manufacturers, developers, analytics, and business organizations which collect data and monitor new equipment, are recognised

- IAC0705   The key barriers in adopting Internet of Things and requirements of Internet of Things are recalled

- IAC0706   Monetization opportunities, monetization strategies, and monetization models arising out of Internet of Things are examined

- IAC0707   The applicability of monetization models is described

(Weight 20%)

1.2.8   KM-01-KT08   :   Internet of Things adoption barriers   5%
Topic elements to be covered include:

- KT0801   Lack of interoperability and unclear value propositions
- KT0802   Privacy and security concerns
- KT0803   Traditional governance structure
- KT0804   Business planning and project management

Internal Assessment Criteria and Weight

- IAC0801   Internet of Things adoption barriers are evaluated to find opportunities to mitigate

(Weight 5%)

1.2.9   KM-01-KT09   :   Security and governance   5%
Topic elements to be covered include:

- KT0901   Legislation

- KT0902   Internet of Things security challenges

- KT0903   Causes of Internet of Things security breaches

- KT0904   Internet of Things security risks

- KT0905   Company standards and policies

Internal Assessment Criteria and Weight

- IAC0901   Security concerns that plague Internet of Things are described

- IAC0902   Current and future security risks related to Internet of Things are examined

- IAC0903   Top 10 causes of security and privacy breaches from OWASP are recognized

- IAC0904   The scenarios of Internet of Things security and privacy breaches are examined

- IAC0905   Security flaws and mitigation measures for enterprises and consumers are stated

- IAC0906   Top governance issues with Internet of Things are recited

(Weight 5%)

1.2.10 KM-01-KT10   :   Security considerations   5%

Topic elements to be covered include:

- KT1001   Security considerations using Internet of Things
- KT1002   Internet of Things security standards and best practices
- KT1003   Internet of Things attack and vulnerabilities
- KT1004   Internet of Things hardware solutions
- KT1005   Internet of Things software solutions
- KT1006   Internet of Things' open-source solutions
- KT1007   Internet of Things Security in utilities challenges

Internal Assessment Criteria and Weight

- IAC1001   Security matters related to IoT are investigated and the impact is identified

- IAC1002   The importance of mitigation of security challenges is stated

(Weight 5%)

1.3 Provider Programme Accreditation Criteria

Physical Requirements:

- The provider must have lesson plans and structured learning material or provide learners with access to structured learning material that addresses all the topics in all the knowledge modules as well as the applied knowledge in the practical skills.

- QCTO/ MICT SETA requirements

Human Resource Requirements:

- Lecturer/learner ratio of 1:20 (Maximum)

- Qualification of lecturer (SME):

   o NQF 6 in industry recognised qualifications with 1 year's experience in the IT industry

   o Vendor certification

- Assessors and moderators: accredited by the MICT SETA

Legal Requirements:

- Legal (product) licences to use the software for learning and training

- OHS compliance certificate

- Ethical clearance (where necessary)

1.4 Exemptions

- No exemptions, but the module can be achieved in full through a normal RPL process

2. 251201-003-00-KM-02, Computers, Devices and Computing Systems, NQF Level 4, Credits 6

2.1 Purpose of the Knowledge Module

The main focus of the learning in this knowledge module is to build an understanding of what computers can do and the processes that make them function in terms of the four major parts: input, output, CPU (central processing unit), and memory. It gives an overview of networks and connectivity

The learning will enable learners to demonstrate an understanding of:

• KM-02-KT01	:	Problem solving skills for IT Professionals	**5%**
• KM-02-KT02	:	Techniques for safety	**5%**
• KM-02-KT03	:	System components	**2%**
• KM-02-KT04	:	Motherboards	**2%**
• KM-02-KT05	:	Processors	**3%**
• KM-02-KT06	:	Memory	**2%**
• KM-02-KT07	:	BIOS and CMOS	**5%**
• KM-02-KT08	:	Hard drives and storage devices	**3%**
• KM-02-KT09	:	Power supplies and voltage	**3%**
• KM-02-KT10	:	Ports, cables and connectors	**2%**
• KM-02-KT11	:	Input and output devices	**2%**
• KM-02-KT12	:	Installing and managing printers	**2%**
• KM-02-KT13	:	Mobile devices, multimedia and laptop computers	**3%**
• KM-02-KT14	:	Preventative maintenance	**5%**
• KM-02-KT15	:	Troubleshooting procedures	**3%**
• KM-02-KT16	:	Operating systems	**5%**
• KM-02-KT17	:	Managing files	**2%**
• KM-02-KT18	:	Applications utility, troubleshooting and optimization	**5%**
• KM-02-KT19	:	Configuring device drivers	**8%**
• KM-02-KT20	:	Networking and wireless connections	**3%**
• KM-02-KT21	:	Recovery	**10%**
• KM-02-KT22	:	Cloud computing	**10%**
• KM-02-KT23	:	Security fundamentals	**5%**
• KM-02-KT24	:	Introduction to applications	**5%**

2.2 Guidelines for Topics

2.2.1   KM-02-KT-01   :   Problem solving skills for IT Professionals   5%

Topic elements to be covered include:

- KT0101   Identification of the problem
- KT0102   Establishing a probable cause
- KT0103   Testing to determine the cause
- KT0104   Establishing a plan to resolve the problem
- KT0105   Implementing your solution
- KT0106   Verifying functionality
- KT0107   Implementing preventative measures,
- KT0108   Documenting results

Internal Assessment Criteria and Weight

- IAC0101   Problem-solving steps and the application thereof are explained.

(Weight 5%)

2.2.2   KM-02-KT-02   :   Techniques for safety   5%
Topic elements to be covered include:

- KT0201   Personal protective equipment

- KT0202   Chemicals

- KT0203   Cables

- KT0204   Hazards (Tripping, electrical, fire, jewellery, etc.)

- KT0205   Environmental risks

- KT0206   Ergonomics and lifting techniques

Internal Assessment Criteria and Weight

- IAC0201   Proper techniques for handling computer components for the safety and the longevity of the hardware are identified and described

(Weight 5%)

2.2.3   KM-02-KT-03   :   System components   2%
Topic elements to be covered include:

- KT0301   Storage devices such as hard drives, magnetic tapes, flash drives
- KT0302   Solid-state drives, such as IDE, SATA, and SCSI
- KT0303   Processors and CPUs, processing speeds, operating systems and controls

Internal Assessment Criteria and Weight

- IAC0301   Various types of system components are identified and described

(Weight 2%)

2.2.4   KM-02-KT-04   :   Motherboards   2%
Topic elements to be covered include:

- KT0401   Function of motherboards
- KT0402   Location of primary components
- KT0403   Motherboard chipsets, audio connections, drive activity light, the power light, on/off buttons, and USB connections

Internal Assessment Criteria and Weight

- IAC0401   Understanding of motherboards, primary components and related aspects is demonstrated

(Weight 2%)

2.2.5   KM-02-KT-05   :   Processors   3%
Topic elements to be covered include:

- KT0501   Processors.
- KT0502   Terminology
- KT0503   Processor speeds in megahertz and gigahertz
- KT0504   Architecture, including registers, cache memory, virtualization, graphics processing units, throttling, and overclocking

Internal Assessment Criteria and Weight

- IAC0501   Understanding of processors and related aspects is demonstrated

(Weight 3%)

2.2.6   KM-02-KT-06   :   Memory   2%
Topic elements to be covered include:

- KT0601   Types of memory: RAM and ROM including DRAM, SRAM, CMOS RAM, and VRAM
- KT0602   Purpose of memory

Internal Assessment Criteria and Weight

- IAC0601   Purpose of memory and how it relates to computer components is described

(Weight 2%)

2.2.7   KM-02-KT-07   :   BIOS and CMOS   5%
Topic elements to be covered include:

- KT0701   BIOS: Basic Input-Output System that runs a computer

- KT0702   Upgrade BIOS

- KT0703   Potential issues

- KT0704   CMOS: Complementary Metal Oxide Semiconductor

- KT0705   CMOS setup, settings, and access

Internal Assessment Criteria and Weight

- IAC0701   Understanding of BIOS and CMOS operations is demonstrated

(Weight 5%)

2.2.8   KM-02-KT-08   :   Hard drives and storage devices   3%
Topic elements to be covered include:

- KT0801   Hard drives and storage devices
- KT0802   Installing discs, formatting discs, partitioning discs, troubleshooting disks, as well as IDE, SCSI and SATA
- KT0803   Parts of a hard disk, such as platters, tracks, sectors, clusters and cylinders
- KT0804   Installing IDE devices

Internal Assessment Criteria and Weight

- IAC0801 An understanding of hard drives, storage devices and components is demonstrated.

- IAC0802 Installing procedures are explained

(Weight 3%)

2.2.9 KM-02-KT-09 : Power supplies and voltage 3%

Topic elements to be covered include:

- KT0901 Power supply units, uninterruptible power supplies
- KT0902 Identifying power supplies
- KT0903 Amps, ohms, volts, and watts
- KT0904 Affecting system hardware and components

Internal Assessment Criteria and Weight

- IAC0901 Power supply and the effect on system hardware and components is explained

(Weight 3%)

2.2.10 KM-02-KT-10 : Ports, cables, and connectors 2%

Topic elements to be covered include:

- KT1001 Ports, cables, and connectors
- KT1002 Power supply units, uninterruptible power supplies and identifying power supplies
- KT1003 Conversion of voltage, overcurrent protection, input supply voltage, DC voltage regulation, input under-voltage and Energy Star designation

Internal Assessment Criteria and Weight

- IAC1001 An understanding of ports, cables and connectors and the effect of voltage is demonstrated

(Weight 2%)

2.2.11 KM-02-KT-11 : Input and output devices 2%

Topic elements to be covered include:

- KT1101 Input devices and function

- KT1102 Output devices and function

- KT1103 Keyboards, mouses, and touchscreens

Internal Assessment Criteria and Weight

- IAC1101 Input and output devices are identified and their respective functions are explained

(Weight 2%)

2.2.12 KM-02-KT-12 : Installing and managing printers 2%

Topic elements to be covered include:

- KT1201 Types of printers
- KT1202 Installing and managing printers
- KT1203 Drivers, paper feed, networking, and user error

Internal Assessment Criteria and Weight

- IAC1201 An understanding of types of printers, installing printers and dealing with problems is demonstrated

(Weight 2%)

2.2.13 KM-02-KT-13 : Mobile devices, multimedia, and laptop computers 3%

Topic elements to be covered include:

- KT1301 Mobile devices
- KT1302 Multimedia
- KT1303 Laptop computers
- KT1304 Troubleshooting common problems: battery or power supply issues, verifying connections, checking the wireless switch, and verifying software configuration

Internal Assessment Criteria and Weight

- IAC1301 The respective functions of mobile devices, multimedia and laptop computers are identified
- IAC1302 Common problems are listed
- IAC1303 Troubleshooting procedures are explained

(Weight 3%)

2.2.14 KM-02-KT-14 : Preventative maintenance 5%

Topic elements to be covered include:

- KT1401 Purpose of preventive maintenance
- KT1402 Benefits
- KT1403 Prevent data loss
- KT1404 Improve performance
- KT1405 Preventive tasks: e.g. Updating virus and malware detectors, backing up data, defragmenting drives, etc.

Internal Assessment Criteria and Weight

- IAC1401 The importance of preventative maintenance is justified
- IAC1402 The purpose and benefits of preventative maintenance are explained
- IAC1403 Preventative procedures are explained

(Weight 5%)

2.2.15   KM-02-KT-15   :   Troubleshooting procedures   3%

Topic elements to be covered include:

- KT1501   Troubleshooting process
- KT1502   Hardware tools required
- KT1503   Software tools e.g. boot disks and system rescue, etc.

Internal Assessment Criteria and Weight

- IAC1501   Troubleshooting procedures are explained

- IAC1502   Hardware and software tools and their respective functions are described

(Weight 3%)

2.2.16   KM-02-KT-16   :   Operating systems   5%

Topic elements to be covered include:

- KT1601   Functions of an operating system: e.g., managing hardware, resources, data and making user interaction easy through the use of a graphical user interface (GUI)
- KT1602   Big three operating systems: Windows, Linux, and Mac.
- KT1603   Control panel
- KT1604   Remote assistance
- KT1605   OS command prompt
- KT1606   OS migration
- KT1607   OS configurations

Internal Assessment Criteria and Weight

- IAC1601   An understanding of operating systems is demonstrated

(Weight 5%)

2.2.17   KM-02-KT-17   :   Managing files   2%

Topic elements to be covered include:

- KT1701   Files and directories, naming conventions and the File Allocation Table (FAT)

- KT1702   Common executable file extensions, such as batch files, command files and power shell scripts and purpose

Internal Assessment Criteria and Weight

- IAC1701   Types of files and their respective purposes are identified

(Weight 2%)

2.2.18   KM-02-KT-18   :   Applications utility, troubleshooting and optimization   5%

Topic elements to be covered include:

- KT1801   Upgrade and remove applications from computers

- KT1802   New installs through disc or internet download

- KT1803   Common processes for downloading and removing software

- KT1804   Troubleshooting

- KT1805   Optimisation

Internal Assessment Criteria and Weight

- IAC1801   Procedures for installing and removing utilities are described

(Weight 5%)

2.2.19   KM-02-KT-19   :   Configuring device drivers   8%
Topic elements to be covered include:

- KT1901   Configuring device drivers

- KT1902   Changing device settings

- KT1903   Updating drivers

- KT1904   Removing device drivers

- KT1905   Plug-and-play devices

- KT1906   Device failure

- KT1907   System restore points

Internal Assessment Criteria and Weight

- IAC1901   Considerations for configuring device drivers are reasoned

(Weight 8%)

2.2.20   KM-02-KT-20   :   Networking and wireless connections   3%
Topic elements to be covered include:

- KT2001   Peer-to-peer networks and server networks
- KT2002   Common functionality of server networks
- KT2003   Three types of network topology: Bus, Star and Ring networks
- KT2004   Networking devices including network interface cards, repeaters, bridges, routers, gateways, hubs and switches

Internal Assessment Criteria and Weight

- IAC2001   Networking and wireless connections are discussed with reference to types and functionality

(Weight 3%)

2.2.21   KM-02-KT-21   :   Recovery   10%

Topic elements to be covered include:

- KT2101   Recovering systems and disaster recovery
- KT2102   Process for disaster recovery
- KT2103   Expecting things to go wrong
- KT2104   Using boot logs to troubleshoot problems
- KT2105   Process for booting a system into safe mode
- KT2106   Emergency repair
- KT2107   Factory repair partitions
- KT2108   Start-up repair
- KT2109   System image recovery

Internal Assessment Criteria and Weight

- IAC2101   Recovery processes are identified and their applications are described

(Weight 10%)

2.2.22   KM-02-KT-22   :   Cloud computing   10%

Topic elements to be covered include:

- KT2201   Network or internet connection
- KT2202   Manipulate, collate, configure and access applications online
- KT2203   Providing support infrastructure, applications and data storage
- KT2204   Benefits and risks to cloud computing as well as cloud characteristics
- KT2205   Cloud storage

Internal Assessment Criteria and Weight

- IAC2201   Cloud computing functionality, benefits and risks are identified and described

(Weight 10%)

2.2.23   KM-02-KT-23   :   Security fundamentals   5%

Topic elements to be covered include:

- KT2301   Business continuity
- KT2302   Disaster recovery planning,
- KT2303   Application development security
- KT2304   Access control
- KT2305   Information security governance
- KT2306   Risk management
- KT2307   Operation security
- KT2308   Physical security
- KT2309   Network security

Internal Assessment Criteria and Weight

- IAC2301   Typical security risks are listed.

- IAC2302   The importance of counter measures is justified

(Weight 5%)

2.2.24   KM-02-KT-24   :   Introduction to applications   5%

Topic elements to be covered include:

- KT2401   Software development

- KT2402   Game development

- KT2403   Software tools

- KT2404   Mobile Apps

- KT2405   Internet of things

Internal Assessment Criteria and Weight

- IAC2401   Various software developments are listed

(Weight 5%)

2.3 Provider Programme Accreditation Criteria

Physical Requirements:

- The provider must have lesson plans and structured learning material or provide learners with access to structured learning material that addresses all the topics in all the knowledge modules as well as the applied knowledge in the practical skills.

- QCTO/ MICT SETA requirements

Human Resource Requirements:

- Lecturer/learner ratio of 1:20 (Maximum)

- Qualification of lecturer (SME):

  o   NQF 6 in industry recognised qualifications with 1 year's experience in the IT industry

  o   Vendor certification

- Assessors and moderators: accredited by the MICT SETA

Legal Requirements:

- Legal (product) licences to use the software for learning and training

- OHS compliance certificate

- Ethical clearance (where necessary)

2.4 Exemptions

- No exemptions, but the module can be achieved in full through a normal RPL process

3. 251201-003-00-KM-03, Building Blocks of Internet of Things, NQF Level 4, Credits 8

3.1 Purpose of the Knowledge Module

The main focus of the learning in this knowledge module is to build an understanding of the elements involved in the architecture and configuration of an IoT ecosystem

The learning will enable learners to demonstrate an understanding of:

- KM-03-KT01   :   Enabling technologies of Internet of Things   **15%**
- KM-03-KT02   :   Four key elements   **5%**
- KM-03-KT03   :   Sensor modules, nodes and systems   **5%**
- KM-03-KT04   :   Actuators   **5%**
- KM-03-KT05   :   Optimal sensor and actuator deployment   **5%**
- KM-03-KT06   :   Gateways   **15%**
- KM-03-KT07   :   Power management   **5%**
- KM-03-KT08   :   Microcontrollers and single board computers   **10%**
- KM-03-KT09   :   Networks   **20%**
- KM-03-KT10   :   Internet of Things platform/cloud   **15%**

3.2 Guidelines for Topics

3.2.1   KM-03-KT01   :   Enabling technologies of Internet of Things   15%

Topic elements to be covered include:

- KT0101   Addressability
- KT0102   Architectural Layers
- KT0103   Short-range wireless
- KT0104   Medium-range wireless
- KT0105   Long-range wireless
- KT0106   Wired
- KT0107   Standards and standards organizations

Internal Assessment Criteria and Weight

- IAC0101   The role and function of enabling technologies in Internet of Things are described

(Weight 15%)

3.2.2   KM-03-KT02   :   Four key elements   5%

Topic elements to be covered include:

- KT0201   Device/ sensor collecting
- KT0202   Network
- KT0203   Cloud/platform
- KT0204   User

Internal Assessment Criteria and Weight

- IAC0201   The four key elements in Internet of Things are differentiated based on the function of each

(Weight 5%)

3.2.3   KM-03-KT03   :   Sensor modules, nodes and systems   5%
Topic elements to be covered include:

- KT0301   Types of sensors: temperature, humidity, pressure, proximity, level, accelerometers, gyroscope, gas, infrared, optical, image
- KT0302   Role of sensors in an Internet of Things device
- KT0303   Capabilities and limitations
- KT0304   Sensor node block diagrams
- KT0305   Sensor deployment

Internal Assessment Criteria and Weight

IAC0301   The function of sensors and nodes as data acquisition systems that collect the great mass of unprocessed data is explained

(Weight 50%)

3.2.4   KM-03-KT04   :   Actuators   5%
Topic elements to be covered include:

- KT0401   Types
- KT0402   Functions
- KT0403   Applications: mechanical, electrical, transducers, automotive, hydraulic, robotics, ultrasonic, electronic devices
- KT0404   Transducers: definition, function, types, conditions, dynamic range, repeatability, noise, applications

Internal Assessment Criteria and Weight

- IAC0401   The functions and application of actuators in Internet of Things is differentiated

(Weight 5%)

3.2.5   KM-03-KT05   :   Optimal sensor and actuator deployment   5%
Topic elements to be covered include:

- KT0501   Sensor/actuator integration
- KT0502   Sensor/actuator compatibility
- KT0503   Device lifecycle management

Internal Assessment Criteria and Weight

- IAC0501   The importance of optimal sensor and actuator deployment is justified in terms of integration, compatibility and lifecycle management

(Weight 5%)

3.2.6   KM-03-KT06   :   Gateways   15%
Topic elements to be covered include:

- KT0601   What it is and key features
- KT0602   Functionality
- KT0603   Edge devices, edge computing, connectivity and protocols
- KT0604   Benefits of using an Internet of Things gateway: Pre-process and filter data and improve response time, security, energy efficiency, protocol translation
- KT0605   Visualisation and machine learning technologies
- KT0606   Complex event processing
- KT0607   Machine learning and artificial intelligence models
- KT0608   Applications and examples
- KT0609   Configure, IP settings and connect a gateway
- KT0610   Offline support
- KT0611   Troubleshooting

Internal Assessment Criteria and Weight

- IAC0601   The function of gateways as converting data into digital streams, filtering and pre-processing it so that it is ready for analysis, is described

- IAC0602   The function of edge devices as they are responsible for further processing and enhanced analysis of data, is reasoned

(Weight 15%)

3.2.7   KM-03-KT07   :   Power management   5%
Topic elements to be covered include:

- KT0701   Processors and power

- KT0702   Power conservation

- KT0703   Power increase – consumption and number of devices

Internal Assessment Criteria and Weight

- IAC0701   The importance of power management in the selection of Internet of Thingshardware is reasoned

(Weight 5%)

3.2.8   KM-03-KT08   :   Microcontrollers and single board computers   10%
Topic elements to be covered include:

- KT0801   Microcontrollers

- KT0802   Microcontroller development boards

- KT0803   Single board computers

- KT0804   Data processing capabilities

- KT0805   Performance

- KT0806   Integrated circuits

Internal Assessment Criteria and Weight

- IAC0801   Microcontrollers and single board computers are defined, types are listed and functionality is explained

- IAC0802   The role of Microcontrollers and single board computers in Internet of Things is described

(Weight 10%)

3.2.9   KM-03-KT09   :   Networks   20%
Topic elements to be covered include:

- KT0901   Connectivity
    - Power consumption vs range vs bandwidth
    - Functions
- KT0902   Options (Wi-Fi or Bluetooth, Low-Power Wide Area Networks (LPWAN), etc.)
- KT0903   Range and speed of data transfer
- KT0904   Deployment requirements
- KT0905   Protocols
- KT0906   Wireless sensor networks
- KT0907   Satellite
- KT0908   Installing cables and implement proper cable management procedures
    - Copper
    - Fibre
    - Connectors
    - Cable placement and routing
    - Labelling
    - Bend radius
    - Plenum cables
    - Cable ties
- KT0909   Network problems, causes, tools and possible solutions

Internal Assessment Criteria and Weight

- IAC0901   Functions of network connectivity are explained

- IAC0902   Various options are compared and contrasted

(Weight 20%)

3.2.10   KM-03-KT10   :   Internet of Things platform/cloud   15%
Topic elements to be covered include:

- KT1001   Versatility and adaptability
- KT1002   Scalability
- KT1003   Security
- KT1004   Signal processing, real-time and local analytics

- KT1005   Databases, cloud analytics and applications
- KT1006   Pricing models
    - Data ownership
    - Potential crashes
    - Latency
- KT1007   Function of a platform

Internal Assessment Criteria and Weight

- IAC1001   The functions of Internet of Things platform/cloud are described

(Weight 15%)

3.3 Provider Programme Accreditation Criteria

Physical Requirements:

- The provider must have lesson plans and structured learning material or provide learners with access to structured learning material that addresses all the topics in all the knowledge modules as well as the applied knowledge in the practical skills.

- QCTO/ MICT SETA requirements

Human Resource Requirements:

- Lecturer/learner ratio of 1:20 (Maximum)

- Qualification of lecturer (SME):

    o   NQF 6 in industry recognised qualifications with 1 year's experience in the IT industry

    o   Vendor certification

- Assessors and moderators: accredited by the MICT SETA

Legal Requirements:

- Legal (product) licences to use the software for learning and training

- OHS compliance certificate

- Ethical clearance (where necessary)

3.4 Exemptions

- No exemptions, but the module can be achieved in full through a normal RPL process

4. 251201-003-00-KM-04, Internet of Things Design and Development Considerations, NQF Level 4, Credits 8

4.1 Purpose of the Knowledge Module

The main focus of the learning in this knowledge module is to build an understanding of design, architecture and configuration of an IoT solution

The learning will enable learners to demonstrate an understanding of:

- KM-04-KT01 : Key tasks an Internet of Things solution needs to perform **10%**
- KM-04-KT02 : Internet of Things integration capabilities **5%**
- KM-04-KT03 : Architecture **10%**
- KM-04-KT04 : Key Internet of Things service providers and their services **5%**
- KM-04-KT05 : Data management, data aggregation and dissemination **10%**
- KM-04-KT06 : Data acquisition and control **10%**
- KM-04-KT07 : Data aggregation and dissemination **5%**
- KM-04-KT08 : Data processing and storage **5%**
- KM-04-KT09 : Common problems in Internet of Things data management **5%**
- KM-04-KT10 : User interface and user experience in Internet of Things **10%**
- KM-04-KT11 : Choosing an Internet of Things service **10%**
- KM-04-KT12 : Creating an application **5%**
- KM-04-KT13 : Internet of Things App development stages **10%**

4.2 Guidelines for Topics

4.2.1   KM-04-KT01   :   Key tasks an Internet of Things solution needs to perform   10%
Topic elements to be covered include:

- KT0101   Acquiring data from the real world (via sensors)
- KT0102   Processing data locally (edge computing)
- KT0103   Connecting to the cloud to send data / receive commands
- KT0104   Storing data in the cloud
- KT0105   Analysing data in the cloud
- KT0106   Commanding the "things" to perform specific tasks based on insights
- KT0107   Presenting insights to users

Internal Assessment Criteria and Weight

- IAC0101   Key tasks an Internet of Things solution needs to perform are listed and explained.

(Weight 10%)

4.2.2   KM-04-KT02   :   Internet of Things integration capabilities   5%
Topic elements to be covered include:

- KT0201   Concept of independently designed applications and data work well together
- KT0202   Integration as the combination of:
    - A mix of new IoT devices, IoT data, IoT platforms and IoT applications
    - Combined with IT assets (business applications, legacy data, mobile, and SaaS)
    - In the context of implementing end-to-end IoT business solutions

Internal Assessment Criteria and Weight

- IAC0201   The importance of efficient integration of the IoT solution elements is evaluated.

(Weight 50%)

4.2.3   KM-04-KT03   :   Architecture   10%

Topic elements to be covered include:

- KT0301   Vertical layers
  - Connected IoT devices
  - IoT gateways
    - o Battery life
    - o Varying protocols
    - o Unfiltered data
    - o High latency
    - o Security
  - IoT platforms
  - IoT applications
- KT0302   Horizontal layers
  - IoT network technologies
  - IoT security technologies

Internal Assessment Criteria and Weight

- IAC0301   The elements of the various layers are listed and explained

(Weight 10%)

4.2.4   KM-04-KT04   :   Key Internet of Things service providers and their services   5%

Topic elements to be covered include:

- KT0401   Key Cloud Service Providers - IBM Watson, Amazon Web Services (AWS), Oracle Cloud, Microsoft Azure IoT Suite, Google Cloud Platform, etc.

Internal Assessment Criteria and Weight

- IAC0401   Various cloud service providers are listed and the various products are compared and contrasted.

(Weight 5%)

4.2.5   KM-04-KT05   :   Data management, data aggregation and dissemination   10%

Topic elements to be covered include:

- KT0501   Datacentres: Cloud or local

- KT0502   IoT Platforms

- KT0503   Choosing an IoT platform

- KT0504   APIs

- KT0505   Data analytics vs ML

- KT0506   Data: ingestion stream:

    - Telemetry data

    - State

    - Alert

    - Action

Internal Assessment Criteria and Weight

- IAC0501   Data management, data aggregation and dissemination is explained.

(Weight 10%)

4.2.6   KM-04-KT06   :   Data acquisition and control   10%
Topic elements to be covered include:

- KT0601   Analog information

- KT0602   Data sample rate

- KT0603   Digital signal

- KT0604   Transmission

- KT0605   Signal conditioning

- KT0606   Analog-to-digital converters

Internal Assessment Criteria and Weight

- IAC0601   The purpose of data acquisition and control is justified.

(Weight 10%)

4.2.7   KM-04-KT07   :   Data aggregation and dissemination   5%
Topic elements to be covered include:

- KT0701   Data aggregation technique
- KT0702   Data dissemination protocols for distributing the data and code between various sensor nodes and providing periodic updates to sensor programs
- KT0703   Energy optimal
- KT0704   The node that generates data is called a source and the information to be reported is called an event
- KT0705   Traffic models

Internal Assessment Criteria and Weight

- IAC0701   The function of data aggregation and dissemination is explained.

(Weight 5%)

4.2.8   KM-04-KT08   :   Data processing and storage   5%

Topic elements to be covered include:

- KT0801   Capability of the device

- KT0802   Analytics: edge vs centralised location

- KT0803   Large volumes of data upstream

- KT0804   Filtering and sending salient data upstream

- KT0805   Network load

Internal Assessment Criteria and Weight

- IAC0801   Data processing and storage functions are described.

(Weight 5%)

4.2.9   KM-04-KT09   :   Common problems in Internet of Things data management   5%

Topic elements to be covered include:

- KT0901   Scalability and Agility

- KT0902   Security

- KT0903   Usefulness

- KT0904   Safety

- KT0905   Filtering

Internal Assessment Criteria and Weight

- IAC0901   Challenges related to the management of large volumes and varieties of data through the full data lifecycle needs are interrogated

(Weight 5%)

4.2.10   KM-04-KT10   :   User interface and user experience in Internet of Things   10%

Topic elements to be covered include:

- KT1001   User interfaces (UIs) and user experience (UX) for IoT

- KT1002   Key considerations for UIs

- KT1003   Native apps

- KT1004   Web apps

- KT1005   Hybrid apps

- KT1006   Dashboards

- KT1007   Responsiveness

Internal Assessment Criteria and Weight

- IAC1001   The importance of and the role of user experience in the IoT solution is reasoned.

(Weight 10%)

4.2.11   KM-04-KT11   :   Choosing an Internet of Things service   10%
Topic elements to be covered include:

- KT1101   Intelligence
- KT1102   Architecture
- KT1103   Complex system
- KT1104   Size considerations
- KT1105   Time considerations
- KT1106   Space considerations
- KT1107   Everything-as-a-service

Internal Assessment Criteria and Weight

- IAC1101   Various factors which should be considered when choosing an IoT service, are compared and contrasted.

(Weight 10%)

4.2.12   KM-04-KT12   :   Creating an application   5%
Topic elements to be covered include:

- KT1201   Ensure the safe collection of data
- KT1202   Organize high-performance data streaming
- KT1203   Create an IoT platform
- KT1204   Develop an IoT solution in the cloud
- KT1205   Provide for effective data management

Internal Assessment Criteria and Weight

- IAC1201   Aspects involved in creating an IoT application are discussed

(Weight 5%)

4.2.13   KM-04-KT13   :   Internet of Things App development stages   10%
Topic elements to be covered include:

- KT1301   Analysis

- KT1302   Design

- KT1303   Implementation

- KT1304   Testing

- KT1305   Deployment

- KT1306   Maintenance

Internal Assessment Criteria and Weight

- IAC1301   The key considerations during each development stage are reasoned

(Weight 10%)

4.3 Provider Programme Accreditation Criteria

Physical Requirements:

- The provider must have lesson plans and structured learning material or provide learners with access to structured learning material that addresses all the topics in all the knowledge modules as well as the applied knowledge in the practical skills.

- QCTO/ MICT SETA requirements

Human Resource Requirements:

- Lecturer/learner ratio of 1:20 (Maximum)

- Qualification of lecturer (SME):

  o NQF 6 in industry recognised qualifications with 1 year's experience in the IT industry

  o Vendor certification

- Assessors and moderators: accredited by the MICT SETA

Legal Requirements:

- Legal (product) licences to use the software for learning and training

- OHS compliance certificate

- Ethical clearance (where necessary)

4.4 Exemptions

- No exemptions, but the module can be achieved in full through a normal RPL process

5. 251201-003-00-KM-05, Data, Databases and Visualisation, NQF Level 4, Credits 4

5.1 Purpose of the Knowledge Module

The main focus of the learning in this knowledge module is to build an understanding of data and databases and giving meaning to data through data processing, analysis and visualisation

The learning will enable learners to demonstrate an understanding of:

- KM-05-KT01   :   Data vulnerability and security   **15%**
- KM-08-KT02   :   Data and data processing   **15%**
- KM-08-KT03   :   Databases, data storage and access to data   **20%**
- KM-08-KT04   :   Structured query language (SQL)   **10%**
- KM-08-KT05   :   Data scraping   **20%**
- KM-08-KT06   :   Software for analysing and visualising data   **20%**

5.2 Guidelines for Topics

5.2.1   KM-05-KT01   :   Data vulnerability and security   15%

Topic elements to be covered include:

- KT0101   Definition

- KT0102   Data vulnerability, risk and exploitation

- KT0103   Stages of data vulnerability: at network level, at system level, at data level

- KT0104   Purpose of protecting data

- KT0105   Process for protecting data

- KT0106   Unauthorised access, elevation of privileges or denial of data

- KT0107   Data corruption

- KT0108   Data security solutions

Internal Assessment Criteria and Weight

   IAC0101   The importance of data security is reasoned

(Weight 15%)

5.2.2   KM-05-KT02   :   Data and data processing   15%

Topic elements to be covered include:

- KT0201   Value of data
- KT0202   Data analysis for IoT: Importance of analysis
- KT0203   Data sourcing:
    - Data sources
    - Data types
    - Reliable data
    - Automated data collection
- KT0204   Refining data:

- Missing data
- Data misalignments
- Separating useful data from the rest
- KT0205   Flaws in data:
  - Commission
  - Omission
  - Perspective
  - Bias
  - Frame of reference
- KT0206   Limits of data acquisition
- KT0207   Data:
  - Setting up data
  - Data interactions
  - Assigned to different fields

Internal Assessment Criteria and Weight

- IAC0201   Data and data processing principles are understood and explained

(Weight 15%)

5.2.3   KM-05-KT03   :   Databases, data storage and access to data   20%

Topic elements to be covered include:

- KT0301   Database:
  - definition, components, function, types, characteristics of good databases, structure and challenges
- KT0302   Data:
  - storage, characteristics of quality data
- KT0303   Data:
  - collection warehousing, mining and managing concepts
- KT0304   Relational database design
- KT0305   Database design tools
- KT0306   Create, design and modify relational database
- KT0307   Import and export data
- KT0308   Design and create queries

Internal Assessment Criteria and Weight

- IAC0301   Database concepts, principles and characteristics are described

- IAC0302   Data concepts, principles and characteristics are described

- IAC0303   Database design concepts, principles and tools are described

- IAC0304   Access to data is described

(Weight 20%)

5.2.4   KM-05-KT04   :   Structured query language (SQL)   10%

Topic elements to be covered include:

- KT0401   SQL programming language
- KT0402   SQL code constructs to perform database transactions
- KT0403   Storing, retrieving, managing or manipulating the data inside a relational database management system (RDBMS)

Internal Assessment Criteria and Weight

- IAC0401   The application of SQL is explained

(Weight 10%)

5.2.5   KM-05-KT05   :   Data scraping   20%
Topic elements to be covered include:

- KT0501   Concept and definition
- KT0502   Purpose of data scraping
- KT0503   Data scraping tools
- KT0504   Legal issues
- KT0505   Web scraping procedure:
    - Find the URL to scrape
    - Inspecting the page
    - Find the data you want to extract
    - Write the code
    - Run the code and extract the data
    - Store the data in the required format
- KT0506   Libraries used for web scraping

Internal Assessment Criteria and Weight

- IAC0501   The principles and purpose of data scraping are explained

(Weight 20%)

5.2.6   KM-05-KT06   :   Software for analysing and visualising data   20%
Topic elements to be covered include:

- KT0601   Reporting
- KT0602   Tables
- KT0603   Pivot tables and pivot charts
- KT0604   Dashboards
- KT0605   Hierarchies and time data
- KT0606   The data model
- KT0607   Importing data from files
- KT0608   Importing data from databases
- KT0609   Importing data from reports
- KT0610   Creating and formatting measures
- KT0611   Visualizing data

Internal Assessment Criteria and Weight

- IAC0601   The importance of analysing and visualising data is reasoned

(Weight 20%)

5.3 Provider Programme Accreditation Criteria

Physical Requirements:

- The provider must have lesson plans and structured learning material or provide learners with access to structured learning material that addresses all the topics in all the knowledge modules as well as the applied knowledge in the practical skills.

- QCTO/ MICT SETA requirements

Human Resource Requirements:

- Lecturer/learner ratio of 1:20 (Maximum)

- Qualification of lecturer (SME):

  o NQF 6 in industry recognised qualifications with 1 year's experience in the IT industry

  o Vendor certification

- Assessors and moderators: accredited by the MICT SETA

Legal Requirements:

- Legal (product) licences to use the software for learning and training

- OHS compliance certificate

- Ethical clearance (where necessary)

5.4 Exemptions

- No exemptions, but the module can be achieved in full through a normal RPL process

6. 251201-003-00-KM-06, 4IR and Future Skills, NQF Level 4, Credits 4

6.1 Purpose of the Knowledge Module

The main focus of the learning in this knowledge module is to build an understanding of the impact of 4IR on communities, individuals and businesses and important skills for future needs

The learning will enable learners to demonstrate an understanding of:

- KM-06-KT01 : 4 IR emerging trends **10%**
- KM-06-KT02 : Computing Knowledge **7%**
- KM-06-KT03 : Future skills and competencies (4IR) **10%**
- KM-06-KT04 : 4 IR trends affecting businesses **10%**
- KM-06-KT05 : Interpersonal skills **5%**
- KM-06-KT06 : Intrapersonal skills **5%**
- KM-06-KT07 : Communication principles and methods **5%**
- KM-06-KT08 : Written business communication **7%**
- KM-06-KT09 : Presentation skills **7%**
- KM-06-KT10 : Teamwork in the workplace **10%**
- KM-06-KT11 : Committees and meetings **5%**
- KM-06-KT12 : Job descriptions and profiles **5%**
- KM-06-KT13 : Customers and stakeholders **7%**
- KM-06-KT14 : Customer service **7%**

6.2 Guidelines for Topics

6.2.1   KM-06-KT01   :   4 IR emerging trends   10%
Topic elements to be covered include:

- KT0101   Artificial intelligence
- KT0102   Cloud computing
- KT0103   Cyber security
- KT0104   Data science
- KT0105   Internet of things
- KT0106   Quality engineering automation
- KT0107   Robotic processing automation
- KT0108   Software programming
- KT0109   Design thinking and innovation
- KT0110   e-Waste

Internal Assessment Criteria and Weight

- IAC0101   The transformational effect that 4IR is having or may have on business ecosystems is understood through a comprehensive knowledge of the emerging trends within 4IR

(Weight 10%)

6.2.2   KM-06-KT02   :   Computing Knowledge   7%
Topic elements to be covered include:

- KT0201   Introduction to programming language
- KT0202   Programming basics
- KT0203   Basic programming knowledge on HTML, JavaScript (or any scripting language)

- KT0204   Software development, e.g. C#, C++, Java, .NET
- KT0205   Databases (SQL or NoSQL)
- KT0206   Web development technologies

Internal Assessment Criteria and Weight

- IAC0201   A sound knowledge of the basics of programming and software development, including various development languages, databases and web development, is demonstrated

(Weight 7%)

6.2.3   KM-06-KT03   :   Future skills and competencies (4IR)   10%

Topic elements to be covered include:

- KT0301   Disruptive thinking (encourage this) (application to their own environment)
- KT0302   Continuously searching for ideas
- KT0303   Think innovatively (analyse the current market and come up with solutions to the current problems)
- KT0304   Soft skills
- KT0305   Programming languages
- KT0306   Operating systems
- KT0307   Open source
- KT0308   Tools for a cloud environment (for configuration and management), tools for debugging, login and monitoring and tools for image
- KT0309   Familiarity with Office tools
- KT0310   Leadership and people management skills

Internal Assessment Criteria and Weight

- IAC0301   A sound knowledge of programming languages, operating systems, the cloud environment, Office tools, etc. is demonstrated

- IAC0302   The importance of analytical and innovative thinking within a business ecosystem that encompasses 4IR, is understood

- IAC0303   Soft skills as well as leadership and people management skills are understood and applied

(Weight 10%)

6.2.4   KM-06-KT04   :   4 IR trends affecting businesses   10%

Topic elements to be covered include:

- KT0401   Afro-centric approach to African problems – taking the best from the existing products and coming up with own solutions; Continental challenges and opportunities
- KT0402   Using Google, Amazon and MS forms and tools to reduce development time (e.g. embed AI APIs)
- KT0403   Business intelligence applications and availability of Big Data (collecting data, converting data into information and turning information into knowledge, knowledge into intelligence and intelligence into wisdom)
- KT0404   Collecting data on clients
- KT0405   Insight into different markets
- KT0406   Automated factories

- KT0407   Exposure to the global world

Internal Assessment Criteria and Weight

- IAC0401   The various IR trends affecting businesses are described and understood within an Afro-centric context, taking into account the existing continental challenges and opportunities for development

- IAC0402   Business Intelligence and Big Data are applied and utilized as marketing tool

- IAC0403   Knowledge of automated factories and insight into the different global markets are displayed

(Weight 10%)

6.2.5   KM-06-KT05   :   Interpersonal skills   5%
Topic elements to be covered include:

- KT0501   Concept, definition and terminology
- KT0502   Principles
- KT0503   Attributes:
    - Social intelligence
    - Confidentiality
    - Conflict handling and resolution
    - Decision making
    - Defending vs attacking
    - Problem solving, Troubleshooting
    - Respect
    - Roles, responsibilities
    - Thinking about the end-user

Internal Assessment Criteria and Weight

- IAC0501   The following universal soft skills are applied in an IR report: flexibility, communication skills, teamwork, literacy, emotional maturity, decision making and adaptability

(Weight 5%)

6.2.6   KM-06-KT06   :   Intrapersonal skills   5%
Topic elements to be covered include:

- KT0601   Concept, definition and terminology
- KT0602   Principles
- KT0603   Attributes:
    - Adaptability
    - Agility
    - Analytical thinking
    - Cognitive thinking skills
    - Emotional maturity
    - Flexibility
    - Planning
    - Problem solving

- Reflection
- Research and investigate
- Self-management
- Strong attention to detail
- Time-management
- Resilience

Internal Assessment Criteria and Weight

- IAC0601   The concept and principles of the intrapersonal skills needed to function effectively within a business ecosystem and with the demands of 4IR in mind, are understood

- IAC0602   The importance of an ability to solve problems through planning, research, investigation, analytical thinking and strong attention to detail, is described

- IAC0603   Effective self-management and time-management are applied

(Weight 5%)

6.2.7   KM-06-KT07   :   Communication principles and methods   5%
Topic elements to be covered include:

- KT0701   Concept, definition and terminology
- KT0702   The different types and forms of communication and communication processes
- KT0703   Communication methods
- KT0704   Barriers to communication
- KT0705   Communication network: Interdepartmental, Supply chain network, etc.
- KT0706   Advantages of good communication
- KT0707   Consequences of poor/no communication

Internal Assessment Criteria and Weight

- IAC0701   The basic principles of communication within a business ecosystem are explained

- IAC0702   Types of communication are defined and compared

- IAC0703   Various communication methods and techniques are compared for effectiveness in the workplace

- IAC0704   Communication flow in the workplace is evaluated

- IAC0705   Reporting structures in the workplace are evaluated

- IAC0706   The importance and the role of recording and reporting of data and information are explained

(Weight 5%)

6.2.8   KM-06-KT08   :   Written business communication   7%
Topic elements to be covered include:

- KT0801   Business requirement specifications
- KT0802   Types

- KT0803   Conventions
- KT0804   Schedules
- KT0805   Reports, reporting protocols and methods
- KT0806   Manuals and guidelines
- KT0807   Work instructions/briefs
- KT0808   Technical report writing
- KT0809   Extracting information from written texts
- KT0810   Policies aligned to standard (IEEE 829-2008 standards)

Internal Assessment Criteria and Weight

- IAC0801   The purpose of written communication within a business ecosystem is stated

- IAC0802   Effective written communication is evaluated

- IAC0803   Work instructions are interpreted and applied

- IAC0804   The purpose and advantages of communication are described

- IAC0805   Definition and purpose of work instructions are described

(Weight 7%)

6.2.9   KM-06-KT09   :   Presentation skills   7%

Topic elements to be covered include:

- KT0901   Concept, definition and terminology
- KT0902   Types: visual, verbal, written
- KT0903   Conventions
- KT0904   Presenting options and solutions
- KT0905   Presenting technical details
- KT0906   Visualisation of business intelligence
- KT0907   Suitable APIs and storytelling using the right tools to:
    - present
    - frame the story
    - focus on certain aspects,
    - pitch,
    - clear terms
    - pictorial

Internal Assessment Criteria and Weight

- IAC0901   The definition and importance of effective presentation skills are understood

- IAC0902   Effective presentation, either visually, verbally or in written form, is applied

- IAC0903   The technical aspects of and solutions for effective presenting, are described

- IAC0904   Suitable APIs are selected and applied in the form of stories in order to visually present business intelligence within the business

(Weight 7%)

6.2.10 KM-06-KT10 : Teamwork in the workplace   10%

Topic elements to be covered include:

- KT1001   Concept, definition and terminology
- KT1002   Principles of teamwork
- KT1003   Advantages of teamwork
- KT1004   Team composition and members
- KT1005   Roles, responsibilities and functions
- KT1006   Team dynamics
- KT1007   Common goals and collaboration
- KT1008   Nature of multidisciplinary teams and teamwork
- KT1009   Setting and achieving targets
- KT1010   Collaboration tools (electronic)

Internal Assessment Criteria and Weight

- IAC1001   The composition of a team within a business ecosystem is described

- IAC1002   The role of a team and its various members is described

- IAC1003   The contribution of a team to an organisation is evaluated

- IAC1004   The dynamics of a well-functioning team are described

- IAC1005   The influence of different team members on team performance is analysed

- IAC1006   External factors which will impact on teamwork are defined

- IAC1007   Internal factors which will impact on teamwork are defined

(Weight 10%)

6.2.11 KM-06-KT11 : Committees and meetings   5%

Topic elements to be covered include:

- KT1101   Procedures
- KT1102   Agendas and minutes
- KT1103   Roles and responsibilities
- KT1104   WSP committees
- KT1105   EE committees
- KT1106   Safety and health committees
- KT1107   Wellness committees

Internal Assessment Criteria and Weight

- IAC1101   The roles and functions of the various committees are defined

- IAC1102   The purpose and objectives of meetings are defined

- IAC1103   Input on correctness of minutes is constructed

(Weight 5%)

6.2.12 KM-06-KT12 : Job descriptions and profiles   5%
Topic elements to be covered include:

- KT1201   Purpose
- KT1202   Job and person specification
- KT1203   Content
- KT1204   Alignment to performance standards

Internal Assessment Criteria and Weight

- IAC1201   Definition and purpose of a job description are described

- IAC1202   A job description is compiled

- IAC1203   A job profile is compiled

(Weight 5%)

6.2.13 KM-06-KT13 : Customers and stakeholders   7%
Topic elements to be covered include:

- KT1301   Concept, definition and terminology
- KT1302   Types of customers
- KT1303   Customer profile
- KT1304   Typical customer behaviour: including habits and mannerisms
- KT1305   Difficult customers
- KT1306   Customer care
- KT1307   Stakeholder management and participation

Internal Assessment Criteria and Weight

- IAC1301   The importance of knowledge about the various types of customers and stakeholders operating within a business ecosystem, is understood

- IAC1302   Culture, habits and nature of customers and stakeholders are taken into account when interaction with these parties is necessitated

(Weight 7%)

6.2.14 KM-06-KT14 : Customer service   7%
Topic elements to be covered include:

- KT1401   Concept, definition and terminology

- KT1402   Customer service principles

- KT1403   Customer centeredness

- KT1404   Handover and sign-off procedures and techniques

- KT1405   Technical documentation

- KT1406   Training in the use of the system

Internal Assessment Criteria and Weight

- IAC1401   The definition, principles and importance of customer service are understood and described

- IAC1402   Technical aspects of customer service, including sign-off procedures and techniques and knowledge of the system used, are described and applied

(Weight 7%)

6.3 Provider Programme Accreditation Criteria

Physical Requirements:

- The provider must have lesson plans and structured learning material or provide learners with access to structured learning material that addresses all the topics in all the knowledge modules as well as the applied knowledge in the practical skills.

- QCTO/ MICT SETA requirements

Human Resource Requirements:

- Lecturer/learner ratio of 1:20 (Maximum)

- Qualification of lecturer (SME):

  o   NQF 6 in industry recognised qualifications with 1 year's experience in the IT industry

  o   Vendor certification

- Assessors and moderators: accredited by the MICT SETA

Legal Requirements:

- Legal (product) licences to use the software for learning and training (where applicable)

- OHS compliance certificate

- Ethical clearance (where necessary)

6.4 Exemptions

- No exemptions, but the module can be achieved in full through a normal RPL process

7. 251201-003-00-KM-07, Design Thinking Principles for Innovation, NQF Level 4, Credits 1

7.1 Purpose of the Knowledge Module

The main focus of the learning in this knowledge module is to build an understanding of the design thinking principles and application in the workplace

The learning will enable learners to demonstrate an understanding of:

- KM-07-KT01 : Introduction to design thinking   **15%**
- KM-07-KT02 : The human element   **10%**
- KM-07-KT03 : Creativity   **20%**
- KM-07-KT04 : Innovation   **20%**
- KM-07-KT05 : Design   **10%**
- KM-07-KT06 : Design thinking methodology   **10%**
- KM-07-KT07 : Application of design thinking   **15%**

7.2 Guidelines for Topics

7.2.1 KM-07-KT01 : Introduction to design thinking   15%

Topic elements to be covered include:

- KT0101   Philosophy

- KT0102   Approach and concepts

- KT0103   Definitions and terminology

- KT0104   History

Internal Assessment Criteria and Weight

- IAC0101   Design thinking methodology is understood

(Weight 15%)

7.2.2 KM-07-KT02 : The human element   10%

Topic elements to be covered include:

- KT0201   Human centeredness

- KT0202   Human participation

Internal Assessment Criteria and Weight

- IAC0201   The principles of design thinking is understood

(Weight 10%)

7.2.3 KM-07-KT03 : Creativity   20%

Topic elements to be covered include:

- KT0301   Creativity: is unleashing the potential of the mind to conceive new ideas

- KT0302   Perceiving the world in new ways

- KT0303   Find hidden patterns

- KT0304   Make connections between seemingly unrelated phenomena

- KT0305   Generate solutions

- KT0306   Application in the workplace

Internal Assessment Criteria and Weight

- IAC0301   Creativity is analysed and possible applications are identified

(Weight 20%)

7.2.4   KM-07-KT04   : Innovation   20%

Topic elements to be covered include:

- KT0401   Innovation: is the action of putting things into practical reality, despite challenges and resistance
- KT0402   Different innovation
    - Incremental
    - Disruptive
    - Architectural and
    - Radical
- KT0403   Main types of innovation:
    - Process innovation
    - Product innovation
    - Organisational innovation
    - Market innovation
- KT0404   What innovation means to business

Internal Assessment Criteria and Weight

- IAC0401   Innovation is analysed and possible applications are identified

(Weight 20%)

7.2.5   KM-07-KT05   : Design   10%

Topic elements to be covered include:

- KT0501   Think outside the box

- KT0502   Push beyond the obvious solutions

- KT0503   Communication through shape and form

Internal Assessment Criteria and Weight

- IAC0501   Design is analysed and possible applications are identified

(Weight 10%)

7.2.6   KM-07-KT06   : Design thinking methodology   10%

Topic elements to be covered include:

- KT0601   Design thinking phases

- KT0602   Design thinking tools and techniques

Internal Assessment Criteria and Weight

- IAC0601   Design thinking phases, tools and techniques are understood

(Weight 10%)

7.2.7   KM-07-KT07   : Application of design thinking   15%

Topic elements to be covered include:

- KT0701   Application in software development

- KT0702   Application in cyber security

- KT0703   Business innovation

- KT0704   Innovative problem solving

Internal Assessment Criteria and Weight

- IAC0701   Possible design thinking applications are explored and discussed

(Weight 15%)

7.3 Provider Programme Accreditation Criteria

Physical Requirements:

- The provider must have lesson plans and structured learning material or provide learners with access to structured learning material that addresses all the topics in all the knowledge modules as well as the applied knowledge in the practical skills.

- QCTO/ MICT SETA requirements

Human Resource Requirements:

- Lecturer/learner ratio of 1:20 (Maximum)

- Qualification of lecturer (SME):

  o NQF 6 in industry recognised qualifications with 1 year's experience in the IT industry

- o Vendor certification

- Assessors and moderators: accredited by the MICT SETA

Legal Requirements:

- Legal (product) licences to use the software for learning and training (where applicable)

- OHS compliance certificate

- Ethical clearance (where necessary)

7.4 Exemptions

- No exemptions, but the module can be achieved in full through a normal RPL process

8. 251201-003-00-KM-08, Basic Electronic Principles, NQF Level 3, Credits 4

8.1 Purpose of the Knowledge Module

The main focus of the learning in this knowledge module is to build an understanding of elementary electronic principles, as they are applicable to sensors applicable to IoT solutions

The learning will enable learners to demonstrate an understanding of:

- KM-08-KT01 : Elementary electronic fundamentals **35%**
- KM-08-KT02 : Elementary electrical fundamentals **30%**
- KM-08-KT03 : Measuring and testing equipment **20%**
- KM-08-KT04 : Renewable energy sources **15%**

8.2 Guidelines for Topics

8.2.1 KM-08-KT01 : Elementary electronic fundamentals 35%

Topic elements to be covered include:

- KT0101 Electronic components including but not limited to resistors, diodes, light emitting diodes (LEDs), relays, switches, primary and secondary cells (batteries)
- KT0102 Electronic components are identified in terms of their respective values
- KT0103 Resistor colour codes
- KT0104 Symbols, functions and uses
- KT0105 Simple circuits
- KT0106 Disposal of obsolete electronic components
- KT0107 Earthing methods

Internal Assessment Criteria and Weight

- IAC0101 A thorough understanding of elementary electronic fundamentals as they relate to electronic security systems is demonstrated

(Weight 35%)

8.2.2 KM-08-KT02 : Elementary electrical fundamentals 30%

Topic elements to be covered include:

- KT0201 Elementary atomic theory is described in terms of the generation of electric current, including but not limited to matter, molecule, element, atom, ion, polarity
- KT0202 Electrical and electronic terms including but not limited to volt, amp, Ohm, coulomb, joules, watts, power, conductors, insulators, direct current, alternating current, series and parallel circuits, Electro-magnetic Force (EMF), capacitance, induction, voltage drop, Radio Frequency Interference (RFI), Electro-magnetic Interference (EMI), impedance, ground loops, electrical earthing, Amp/Hour, frequency
- KT0203 Ohm's law is defined and used to perform electrical calculations (resistance, voltage, current and power in electrical circuits) in elementary electrical circuits (series and parallel circuits. This must also cover the use of resistors and batteries (secondary cells) in series and parallel)
- KT0204 Magnetism: permanent magnetism, induced magnetism, electromagnetism, magnetic field, and magnetic field strength

Internal Assessment Criteria and Weight

- IAC0201 A thorough understanding of elementary electrical fundamentals as they relate to electrical

and electronic security systems is demonstrated

(Weight 30%)

8.2.3   KM-08-KT03   :   Measuring and testing equipment   20%

Topic elements to be covered include:

- KT0301   Multi meters including working condition and accuracy
- KT0302   Function and range (voltage, current and resistance modes at different levels)
- KT0303   Use of testing equipment
- KT0304   Continuity tests
- KT0305   Handling, transporting, storage and cleaning.

Internal Assessment Criteria and Weight

- IAC0301   A thorough understanding of the use of measuring and testing equipment as it relates to electrical and electronic security systems is demonstrated

(Weight 20%)

8.2.4   KM-08-KT04   :   Renewable energy sources   15%

Topic elements to be covered include:

- KT0401   Types
- KT0402   Solar panels
- KT0403   Application in the security industry

Internal Assessment Criteria and Weight

IAC0401   An awareness of renewable energy sources is demonstrated

(Weight 15%)

8.3 Provider Programme Accreditation Criteria

Physical Requirements:

- The provider must have lesson plans and structured learning material or provide learners with access to structured learning material that addresses all the topics in all the knowledge modules as well as the applied knowledge in the practical skills.

- QCTO/ MICT SETA requirements

Human Resource Requirements:

- Lecturer/learner ratio of 1:20 (Maximum)

- Qualification of lecturer (SME):

  o   NQF 6 in industry recognised qualifications with 1 year's experience in the IT industry

  o   Vendor certification

- Assessors and moderators: accredited by the MICT SETA

Legal Requirements:

- Legal (product) licences to use the software for learning and training

- OHS compliance certificate

- Ethical clearance (where necessary)

8.4 Exemptions

- No exemptions, but the module can be achieved in full through a normal RPL process

SECTION 3B: PRACTICAL SKILLS MODULE SPECIFICATIONS

List of Practical Skills Module Specifications

Practical Skills	251201-003-00-PM-01	Apply Basic Scriptwriting for Internet of Things Toolsets	4	4
Practical Skills	251201-003-00-PM-02	Access, Analyse and Visualise Structured Data using Spreadsheets	4	4
Practical Skills	251201-003-00-PM-03	Implement the Internet of Things Solution Infrastructure and Deploy Edge Devices	4	10
Practical Skills	251201-003-00-PM-04	Provision and Manage Devices	4	10
Practical Skills	251201-003-00-PM-05	Process and Manage Data in an Internet of Things Solution	4	8
Practical Skills	251201-003-00-PM-06	Monitor, Troubleshoot and Optimise Internet of Things Solutions	4	8
Practical Skills	251201-003-00-PM-07	Implement Security Measures for Internet of Things Solutions	4	10
Practical Skills	251201-003-00-PM-08	Participate in a Design Thinking for Innovation Workshop	4	3
Practical Skills	251201-003-00-PM-09	Function Ethically and Effectively in the Workplace	4	3

1. 251201-003-00-PM-01, Apply Basic Scriptwriting for Internet of Things Toolset, NQF Level 4, Credits 4

1.1 Purpose of the Practical Skills Module

The focus of the learning in this module is on providing the learner with an opportunity to acquire the skills to apply basic scripting skills to use a toolsets in the field of study or employment

The learner will be required to:

- PM-01-PS01 : Source and compare at least three software toolkits/platforms/ languages used in your field of studies
- PM-01-PS02 : Set up an editing environment (tailored to a specific tool or platform)
- PM-01-PS03 : Write a script using a Command Line Interface/Terminal session for giving instructions for use of a toolset
- PM-01-PS04 : Script write loops (tailored to a specific tool or platform)
- PM-01-PS05 : Handle errors (tailored to a specific tool or platform)
- PM-01-PS06 : Apply general steps for writing script (tailored to a specific tool or platform)
- PM-01-PS07 : Practical exercise using the specified product set

1.2 Guidelines for Practical Skills

1.2.1 PM-01-PS01 : Source and compare at least three software toolkits/platforms/ languages used in your field of studies

Scope of Practical Skill

Given access to the internet, the learner must be able to:

- PA0101 Identify at least three most suitable software toolkits/platforms in the field of studies or employment

- PA0102 Source these from the internet

- PA0103 Compare these in terms of advantages and disadvantages related to the field of study or employment

Applied Knowledge

- AK0101 Software toolkit / software
- AK0102 Computer hardware

Internal Assessment Criteria

- IAC0101 At least three suitable software toolkits/platforms/languages necessary for field of study are sourced from the internet and compared for suitability in terms of advantages/disadvantages

1.2.2 PM-01-PS02 : Set up an editing environment (tailored to a specific tool or platform)

Scope of Practical Skill

Given a problem statement and access to a suitable PC or device with software toolkit/platform, the learner must be able to:

- PA0201 Choose an editor or utility in line with the application and the paradigm
- PA0202 Install a programming environment and/or language specific to a programming language and configure for use

Applied Knowledge

- AK0201   Cybersecurity utility
- AK0202   Software toolkit / software
- AK0203   Hardware

Internal Assessment Criteria

- IAC0201   A programming environment is created and a programming language that is in line with the chosen paradigm (e.g., Java) is configured for use in the environment

1.2.3   PM-01-PS03   :   Write a script using a Command Line Interface/Terminal session for giving instructions for use of a toolset

Scope of Practical Skill

Given a problem statement and access to a suitable PC or device with security software toolset, the learner must be able to:

- PA0301   Write a script using a Command Line Interface/Terminal session for giving instructions for use of a toolset
- PA0302   Select and use correct data types (tailored to a specific tool or platform)
- PA0303   Use complex types to organise data and create expressions
- PA0304   Use and apply: If-else statements, Booleans
- PA0301   SQL injection attacks: Inject special characters

Applied Knowledge

- AK0301   Coding language
- AK0302   Software toolkit / software
- AK0303   Hardware

Internal Assessment Criteria

- IAC0301   Script is written using a CLI
- IAC0302   Correct data types are identified as pertaining to the scripting activity
- IAC0303   Principles of complex types are applied during scripting

1.2.4   PM-01-PS04   :   Script write loops (tailored to a specific tool or platform)

Scope of Practical Skill

Given a problem statement and access to a suitable PC or device with software toolkit/platform, the learner must be able to:

- PA0401   Use and apply:
  - While loops
  - Iterating loops
  - Nested loops

Applied Knowledge

- AK0401   Types of loops
- AK0402   Checking conditions
- AK0403   Initializer, condition, iterator
- AK0404   Sequence

Internal Assessment Criteria

- IAC0401   Loops are used to repeat operations

1.2.5 PM-01-PS01 : Handle errors (tailored to a specific tool or platform)

Scope of Practical Skill

Given a problem statement and access to a suitable PC or device with software toolkit/platform, the learner must be able to:

- PA0101 Identify errors peculiar to the platform and how best to handle them:
    - Bugs, testing and debugging
    - Exceptions: thrown and caught and logged
    - Exception handling
    - Code the application to recover by itself
    - Error tracking
    - Fix errors

Applied Knowledge

- AK0101 Types of errors
- AK0102 Types of testing
- AK0103 Possible causes
- AK0104 Anticipation, detection and resolution of programming, application and communication errors

Internal Assessment Criteria

- IAC0101 Various types of errors are handled

1.2.6 PM-01-PS06 : Apply general steps for writing script (tailored to a specific tool or platform)

Scope of Practical Skill

Given a problem statement and access to a suitable PC or device with software toolkit/platform, the learner must be able to:

- PA0601 Understand the problem you are trying to solve
- PA0602 Design a solution
- PA0603 Draw a flow chart
- PA0604 Write pseudo-code
- PA0601 Write script
- PA0606 Test and debug
- PA0607 Insert comments in script and provide proper documentation that will guide other developers through the algorithm and logic that was implemented
- PA0608 Finalise documentation
- PA0609 Test with real-world users
- PA0610 Release script
- PA0611 Iterate the steps for next version

Applied Knowledge

- AK0601 Command line interface (CLI) and minimum commands
- AK0602 Using cybersecurity software toolset

Internal Assessment Criteria

- IAC0601 The general steps for writing a script are understood and applied and results tested before the program is released and the steps repeated for the next version

1.2.7 PM-01-PS07   :   Practical exercise using the specified product set

Scope of Practical Skill

Given access to a suitable PC or device with software toolkit/platform, the learner must be able to:

- PA0701   Create a text file
- PA0702   Write a script that extract MAC (media access control)
- PA0703   Pull up current user name and drop into text file
- PA0704   Write script that extracts information on the current security posture of a machine within its environment

Applied Knowledge

- AK0701   Language
- AK0702   Coding
- AK0703   Using software toolkit / platform

Internal Assessment Criteria

- IAC0701   Desired outcome is achieved

1.3 Provider Programme Accreditation Criteria

Physical Requirements:

- Valid licenses software and application, including OS.

- Internet connection and hardware availability

- Examples and information specified in the scope statement and all the case studies, scenarios and access to hardware and software implied in the scope statements of the modules.

- Remote learners: Provider must provide business IT simulation system (e.g. invoice processing).

Human Resource Requirements:

- Lecturer/learner ratio of 1:10 (Maximum)

- Qualification of lecturer (SME):

    o   NQF 6 industry recognised qualification with 1 year's experience in the IT industry

    o   Vendor certification

- Assessors and moderators: accredited by the MICT SETA

Legal Requirements:

- Legal (product) licences to use the software for learning and training

- OHS compliance certificate

- Ethical clearance (where necessary)

1.4 Exemptions

- No exemptions, but the module can be achieved in full through a normal RPL process

2. 251201-003-00-PM-02, Access, Analyse and Visualise Structure Data using Spreadsheets, NQF Level 4, Credits 4

2.1 Purpose of the Practical Skills Module

The focus of the learning in this module is on providing the learner with an opportunity to acquire the skills to analyse and visualise data

The learner will be required to:

- PM-02-PS01 : Report data
- PM-02-PS02 : Summarise and format data using tables
- PM-02-PS03 : Create, use and edit pivot tables and pivot charts
- PM-02-PS04 : Create, use and edit dashboards
- PM-02-PS05 : Create and configure hierarchies and time data
- PM-02-PS06 : Apply a data model
- PM-02-PS07 : Import data from files
- PM-02-PS08 : Import data from databases
- PM-02-PS09 : Import data from reports
- PM-02-PS10 : Visualize data

2.2 Guidelines for Practical Skills

2.2.1 PM-02-PS01 : Report data
Scope of Practical Skill

Given a suitable problem to solve, the learner must be able to:

- PA0101 Create report
- PA0102 Filter and format data
- PA0103 Create charts

Applied Knowledge

- AK0101 Data analysis
- AK0102 Functions and capabilities

Internal Assessment Criteria

- IAC0101 Reporting is done by creating charts containing the correct data

2.2.2 PM-02-PS02 : Summarise and format data using tables
Scope of Practical Skill

Given a suitable problem to solve, a PC or laptop and software, the learner must be able to:

- PA0201 Create a table
- PA0202 Summarise data
- PA0203 Sort, filter, and validate data
- PA0204 Format summarized data

Applied Knowledge

- AK0201 Data analysis
- AK0202 Functions and capabilities

Internal Assessment Criteria

- IAC0201   A table is created and summarized data sorted, filtered, validated and formatted

2.2.3 PM-02-PS03   :   Create, use and edit pivot tables and pivot charts
Scope of Practical Skill

Given a suitable problem to solve, a PC or laptop and software, the learner must be able to:

- PA0301   Use pivot tables and pivot charts
- PA0302   Import data from a CSV file
- PA0303   Create a pivot table
- PA0304   Edit pivot tables and pivot charts

Applied Knowledge

- AK0301   Data analysis
- AK0302   Functions and capabilities

Internal Assessment Criteria

- IAC0301   Pivot tables and charts are created, used and edited, using data imported from a CSV file

2.2.4 PM-02-PS04   :   Create, use and edit dashboards
Scope of Practical Skill

Given a suitable problem to solve, a PC or laptop and software, the learner must be able to:

- PA0401   Create dashboards
- PA0402   Conduct data analysis in excel pivot tables
- PA0403   Arrange tables and charts
- PA0404   Slice data
- PA0405   Filter data using a slicer
- PA0406   Add calculated columns to a dashboard
- PA0407   Find anomalies

Applied Knowledge

- AK0401   Data analysis
- AK0402   Functions and capabilities

Internal Assessment Criteria

- IAC0401   Dashboards are created containing data backed tables and charts, data are sliced, filtered and calculated and anomalies found

2.2.5 PM-02-PS05   :   Create and configure hierarchies and time data
Scope of Practical Skill

Given a suitable problem to solve, a PC or laptop and software, the learner must be able to:

- PA0501   Create a hierarchy
- PA0502   Configure time data
- PA0503   Create an animated time chart

Applied Knowledge

- AK0501   Data analysis

- AK0502   Functions and capabilities

Internal Assessment Criteria

- IAC0501   Hierarchies are created, time data is configured and an animated time chart is created

2.2.6 PM-02-PS06   :   Apply a data model
Scope of Practical Skill

Given a suitable problem to solve, a PC or laptop and software, the learner must be able to:

- PA0601   Explore a data model
- PA0602   Add multiple tables
- PA0603   Create relationships
- PA0604   Add external data
- PA0605   Import external data and use it
- PA0606   Link out to external data
- PA0607   Use the DAX (data analysis expressions) function
- PA0608   View data within a data table

Applied Knowledge

- AK0601   Data analysis
- AK0602   Functions and capabilities

Internal Assessment Criteria

   IAC0601   A data model is applied for integrating data from various imported tables and creating relationships between them

2.2.7 PM-02-PS07   :   Import data from files
Scope of Practical Skill

Given a suitable problem to solve, a PC or laptop and software, the learner must be able to:

- PA0701   Pre-format and import CSV files
- PA0702   Import data into the software program
- PA0703   Shape and transform data
- PA0704   Load data

Applied Knowledge

- AK0701   Data analysis
- AK0702   Functions and capabilities

Internal Assessment Criteria

- IAC0701   Data are imported from pre-formatted files into excel and configured

2.2.8 PM-02-PS08   :   Import data from databases
Scope of Practical Skill

Given a suitable problem to solve, a PC or laptop and software, the learner must be able to:

- PA0801   Import data from a SQL server database
- PA0802   Identify available data sources

- PA0803 Preview, shape and transform data
- PA0804 Table relationships and hierarchies
- PA0805 Load data

Applied Knowledge

- AK0801 Data analysis
- AK0802 Functions and capabilities

Internal Assessment Criteria

- IAC0801 Data are imported from various identified databases and configured, taking table relationships and hierarchies into account

2.2.9 PM-02-PS09 : Import data from reports

Scope of Practical Skill

Given a suitable problem to solve, a PC or laptop and software, the learner must be able to:

- PA0901 Import data from reports
- PA0902 Transform report data

Applied Knowledge

- AK0901 Data analysis
- AK0902 Functions and capabilities

Internal Assessment Criteria

- IAC0901 Data are imported from reports and converted

2.2.10 PM-02-PS10 : Visualize data

Scope of Practical Skill

Given a suitable problem to solve, a PC or laptop and software, the learner must be able to:

- PA1001 Create and format measures
- PA1002 Visualize data using:
  - Pivot charts
  - Cube functions
  - Charts for cube functions
- PA1003 Create and refine a pivot chart

Applied Knowledge

- AK1001 Cube functions and when to use them
- AK1002 A number of charts for use with cube functions

Internal Assessment Criteria

- IAC1001 Data is visualized in excel with created and refined pivot charts and charts with cube functions in order to produce a graphical representation of a set of data

2.3 Provider Programme Accreditation Criteria

Physical Requirements:

- Valid licenses software and application, including OS.

- Internet connection and hardware availability

- Examples and information specified in the scope statement and all the case studies, scenarios and access to hardware and software implied in the scope statements of the modules.

- Remote learners: Provider must provide business IT simulation system (e.g. invoice processing).

Human Resource Requirements:

- Lecturer/learner ratio of 1:10 (Maximum)

- Qualification of lecturer (SME):

  o NQF 6 industry recognised qualification with 1 year's experience in the IT industry

  o Vendor certification

- Assessors and moderators: accredited by the MICT SETA

Legal Requirements:

- Legal (product) licences to use the software for learning and training

- OHS compliance certificate

- Ethical clearance (where necessary)

2.4 Exemptions

- No exemptions, but the module can be achieved in full through a normal RPL process

3. 251201-003-00-PM-03, Implement the Internet of Things Solution Infrastructure and Deploy Edge Devices, NQF Level 4, Credits 10

3.1 Purpose of the Practical Skills Module

The focus of the learning in this module is on providing the learner with an opportunity to implement an IoT solution infrastructure and deploy edge devices.

The learner will be required to:

- PM-03-PS01   :   Design a suitable IoT platform architecture and identify critical data entities for a simple IoT solution
- PM-03-PS02   :   Design robust, maintainable high-performance IoT systems
- PM-03-PS03   :   Connect and establish communication with a sensor
- PM-03-PS04   :   Create and configure an IoT Hub
- PM-03-PS05   :   Build device messaging and communication
- PM-03-PS06   :   Configure physical IoT devices
- PM-03-PS07   :   Set up and deploy an IoT Edge device
- PM-03-PS08   :   Develop modules
- PM-03-PS09   :   Configure an IoT Edge device

3.2 Guidelines for Practical Skills

3.2.1   PM-03-PS01   :   Design a suitable IoT platform architecture and identify critical data entities for a simple IoT solution

Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0101   Gather device information and pay load details from IoT devices
- PA0102   Analyze and define data into WIoTP data format
- PA0103   Identify data required for historical view
- PA0104   Identify data for normalisation
- PA0105   Identify data for monitoring and management actions

Applied Knowledge

- AK0101   IoT platform functionalities

Internal Assessment Criteria

- IAC0101   A suitable IoT platform architecture and identify critical data entities for a simple IoT solution is designed.

3.2.2   PM-03-PS02   :   Design robust, maintainable high-performance IoT systems

Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0201   Apply an understanding of full IoT system development life-cycle:
    - Understanding the needs of the business
    - Specifications
    - Power requirements
    - Security issues
    - Deployment

- Maintenance
- PA0202   Design robust, maintainable high-performance IoT systems

Applied Knowledge

- AK0201   Full IoT system development life-cycle

Internal Assessment Criteria

- IAC0201   **Robust, maintainable high-performance IoT systems are designed.**

3.2.3   PM-03-PS03   : Connect and establish communication with a sensor

Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0301   Register a sensor within the IoT Core
- PA0302   Secure the sensor using IoT policies
- PA0303   Establish communication with the sensor
- PA0304   Collect data from the sensor
- PA0305   Redirect the data using the IoT rules engine
- PA0306   Visualize the data

Applied Knowledge

- AK0301   Platform language, commands and instructions
- AK0302   Sensor protocols

Internal Assessment Criteria

- IAC0301   A sensor is connected and data is collected and presented

3.2.4   PM-03-PS04   : Create and configure an IoT Hub

Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0401   Create an IoT Hub
- PA0402   Register a device
- PA0403   Configure a device twin
- PA0404   Configure IoT Hub tier and scaling

Applied Knowledge

- AK0401   Platform language, commands and instructions

Internal Assessment Criteria

- IAC0401   An IoT Hub is successfully and accurately created and configured

3.2.5   PM-03-PS05   : Build device messaging and communication

Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0501 Build messaging solutions by using a collection of software development tools and libraries required to develop applications (device and service)
- PA0502 Implement device-to-cloud communication
- PA0503 Implement cloud-to-device communication
- PA0504 Configure file upload for devices
- PA0505 Connect to IoT Hub using TLS server certificates

Applied Knowledge

- AK0501 Platform language, commands and instructions

Internal Assessment Criteria

- IAC0501 Messaging and communication functionality are established

3.2.6 PM-03-PS06 : Configure physical IoT devices

Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0601 Recommend an appropriate protocol based on device specifications
- PA0602 Configure device networking, topology and connectivity

Applied Knowledge

- AK0601 Platform language, commands and instructions

Internal Assessment Criteria

- IAC0601 Physical IoT devices are configured.

3.2.7 PM-03-PS07 : Set up and deploy an IoT Edge device

Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0701 Create a device identity in IoT Hub
- PA0702 Deploy a single IoT device to IoT Edge
- PA0703 Create a deployment for IoT Edge devices
- PA0704 Install container runtime on IoT devices
- PA0705 Define and implement deployment manifest
- PA0706 Update security daemon and runtime
- PA0707 Provision IoT Edge devices with DPS
- PA0708 IoT Edge automatic deployments
- PA0709 Deploy on constrained devices
- PA0710 Secure IoT Edge solutions
- PA0711 Deploy production certificates

Applied Knowledge

- AK0701 Platform language, commands and instructions

Internal Assessment Criteria

- IAC0701 An IoT device is set up and deployed.

3.2.8 PM-03-PS08   : Develop modules

Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0801   Create and configure an Edge module
- PA0802   Deploy a module to an Edge device
- PA0803   Publish an IoT Edge module to a Container Registry
- PA0804   Debug Edge modules in development environment

Applied Knowledge

- AK0801   Platform language, commands and instructions

Internal Assessment Criteria

- IAC0801   Modules for edge computing are developed.

3.2.9 PM-03-PS09   : Configure an IoT Edge device

Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0901   Select and deploy an appropriate gateway pattern
- PA0902   Implement Industrial IoT solutions with modules like Modbus and OPC
- PA0903   Implement module-to-module communication
- PA0904   Implement and configure offline support (including local storage)

Applied Knowledge

- AK0901   Platform language, commands and instructions

Internal Assessment Criteria

- IAC0901   An IoT device is configured.

3.3 Provider Programme Accreditation Criteria

Physical Requirements:

- Valid licenses software and application, including OS.

- Internet connection and hardware availability

- Examples and information specified in the scope statement and all the case studies, scenarios and access to hardware and software implied in the scope statements of the modules.

- Remote learners: Provider must provide business IT simulation system (e.g. invoice processing).

Human Resource Requirements:

- Lecturer/learner ratio of 1:10 (Maximum)

- Qualification of lecturer (SME):

  o NQF 6 industry recognised qualification with 1 year's experience in the IT industry

○　Vendor certification

- Assessors and moderators: accredited by the MICT SETA

Legal Requirements:

- Legal (product) licences to use the software for learning and training

- OHS compliance certificate

- Ethical clearance (where necessary)

3.4 Exemptions

- No exemptions, but the module can be achieved in full through a normal RPL process

4. 251201-003-00-PM-04, Provision and Manage Devices, NQF Level 4, Credits 10

4.1 Purpose of the Practical Skills Module

The focus of the learning in this module is on providing the learner with an opportunity to provision and manage IoT devices.

The learner will be required to:

- PM-04-PS01   :   Implement the Device Provisioning Service (DPS)
- PM-04-PS02   :   Manage the device lifecycle
- PM-04-PS03   :   Manage IoT devices by using IoT Hub
- PM-04-PS04   :   Build a solution by using IoT Central

4.2 Guidelines for Practical Skills

4.2.1   PM-04-PS01   :   Implement the Device Provisioning Service (DPS)
Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0101   Create a device provisioning service
- PA0102   Create a new enrolment in DPS
- PA0103   Manage allocation policies by using the functions of the cloud platform
- PA0104   Link an IoT Hub to the DPS

Applied Knowledge

- AK0101   Platform language, commands and instructions

Internal Assessment Criteria

- IAC0101   The DPS is successfully implemented

4.2.2   PM-04-PS02   :   Manage the device lifecycle
Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0201   Provision a device by using DPS
- PA0202   De-provision an auto enrolment
- PA0203   Decommission (disenroll) a device

Applied Knowledge

- AK0201   Platform language, commands and instructions
- AK0202   Beginning of Life (BoL), Middle of Life (MoL) and End of Life (EoL)

Internal Assessment Criteria

- IAC0201   The device lifecycle is managed

4.2.3   PM-04-PS03   :   Manage IoT devices by using IoT Hub
Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0301   Manage device list in the IoT Hub device registry

- PA0302   Modify device twin tags and properties
- PA0303   Trigger an action on a set of devices by using IoT Hub Jobs and Direct Methods
- PA0304   Set up Automatic Device Management of IoT devices at scale

Applied Knowledge

- AK0301   Platform language, commands and instructions

Internal Assessment Criteria

- IAC0301   An IoT Hub is used to manage IoT devices

4.2.4   PM-04-PS04   :   Build a solution by using IoT Central
Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0401   Define a device type in IoT Central
- PA0402   Configure rules and actions in IoT Central
- PA0403   Define the operator view
- PA0404   Add and manage devices from IoT Central
- PA0405   Monitor devices
- PA0406   Custom and industry-focused application templates
- PA0407   Monitor application health using metrics
- PA0408   Run IoT Central jobs

Applied Knowledge

- AK0401   Platform language, commands and instructions

Internal Assessment Criteria

- IAC0401   A solution is built by using IoT Central

4.3 Provider Programme Accreditation Criteria

Physical Requirements:

- Valid licenses software and application, including OS.

- Internet connection and hardware availability

- Examples and information specified in the scope statement and all the case studies, scenarios and access to hardware and software implied in the scope statements of the modules.

- Remote learners: Provider must provide business IT simulation system (e.g. invoice processing).

Human Resource Requirements:

- Lecturer/learner ratio of 1:10 (Maximum)

- Qualification of lecturer (SME):

  - o NQF 6 industry recognised qualification with 1 year's experience in the IT industry

  - o Vendor certification

- Assessors and moderators: accredited by the MICT SETA

Legal Requirements:

- Legal (product) licences to use the software for learning and training

- OHS compliance certificate

- Ethical clearance (where necessary)

4.4 Exemptions

- No exemptions, but the module can be achieved in full through a normal RPL process

5. 251201-003-00-PM-05, Process and Manage Data in an Internet of Things Solution, NQF Level 4, Credits 8

5.1 Purpose of the Practical Skills Module

The focus of the learning in this module is on providing the learner with an opportunity to process and manage date in an IoT solution

The learner will be required to:

- PM-05-PS01   :   Configure routing in IoT Hub
- PM-05-PS02   :   Configure stream processing
- PM-05-PS03   :   Configure an IoT solution for Time Series Insights (TSI)

5.2 Guidelines for Practical Skills

5.2.1   PM-05-PS01   :   Configure routing in IoT Hub
Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0101   Implement message enrichment in IoT Hub
- PA0102   Configure routing of IoT Device messages to endpoints
- PA0103   Define and test routing queries
- PA0104   Integrate with Event Grid

Applied Knowledge

- AK0101   Platform language, commands and instructions

Internal Assessment Criteria

- IAC0101   Routing in IoT is configured.

5.2.2   PM-05-PS02   :   Configure stream processing
Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0201   Create ASA for data and stream processing of IoT data
- PA0202   Process and filter IoT data by using platform functions
- PA0203   Configure stream analytics outputs
- PA0204   Create stream analytics Edge module

Applied Knowledge

- AK0201   Platform language, commands and instructions

Internal Assessment Criteria

- IAC0201   Stream processing is configured.

5.2.3   PM-05-PS03   :   Configure an IoT solution for Time Series Insights (TSI)
Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0301   Implement solutions to handle telemetry and time-stamped data

- PA0302   Create a Time Series Insights (TSI) environment
- PA0303   Connect the IoT Hub and the Time Series Insights (TSI)

Applied Knowledge

- AK0301   Platform language, commands and instructions

Internal Assessment Criteria

- IAC0301   TSI of an IoT solution is configured.

5.3 Provider Programme Accreditation Criteria

Physical Requirements:

- Valid licenses software and application, including OS.

- Internet connection and hardware availability

- Examples and information specified in the scope statement and all the case studies, scenarios and access to hardware and software implied in the scope statements of the modules.

- Remote learners: Provider must provide business IT simulation system (e.g. invoice processing).

Human Resource Requirements:

- Lecturer/learner ratio of 1:10 (Maximum)

- Qualification of lecturer (SME):

  o   NQF 6 industry recognised qualification with 1 year's experience in the IT industry

  o   Vendor certification

- Assessors and moderators: accredited by the MICT SETA

Legal Requirements:

- Legal (product) licences to use the software for learning and training

- OHS compliance certificate

- Ethical clearance (where necessary)

5.4 Exemptions

- No exemptions, but the module can be achieved in full through a normal RPL process

6. 251201-003-00-PM-06, Monitor, Troubleshoot and Optimise Internet of Things Solutions, NQF Level 4, Credits 8

6.1 Purpose of the Practical Skills Module

The focus of the learning in this module is on providing the learner with an opportunity to acquire the skills to monitor, troubleshoot and optimise IoT solutions.

The learner will be required to:

- PM-06-PS01 : Design an approach for device management
- PM-06-PS02 : Configure IoT health monitoring
- PM-06-PS03 : Troubleshoot device communication
- PM-06-PS04 : Perform end-to-end solution testing and diagnostics

6.2 Guidelines for Practical Skills

6.2.1 PM-06-PS01 : Design an approach for device management

Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0101 Identify requirements for device connectivity and authentication
  - Determine which devices will connect directly, which will connect through a gateway, which will connect via 3rd party platforms
  - Determine how the gateways or directly-connected devices are going to authenticate (token or PKI) with IoT
  - Determine how the gateways or directly-connected devices are going to be provisioned with the authentication credentials that they will need
- PA0102 Identify requirements for device monitoring and diagnostics
  - Determine the processes for device troubleshooting. What diagnostic information do the devices provide?
- PA0103 Identify requirements for device software maintenance and updates
  - Define a mechanism for updating the firmware on the devices/gateways
  - Identify firmware update server
  - Identify the requirements for scheduling firmware update. Are there specific times when update on a device can be performed? Are there constraints involving updates of multiple devices (e.g. don't update B while A is being updated)
- PA0104 Determine whether device management will be performed in-house or outsourced
- PA0105 Determine whether the devices need IoT management agents installed on them

Applied Knowledge

- AK0101 How to interrogate design specifications

Internal Assessment Criteria

- IAC0101 An approach for device management is designed.

6.2.2 PM-06-PS02 : Configure IoT health monitoring

Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0201 Monitor the technical performance of internal systems
- PA0202 Configure metrics in IoT Hub

- PA0203   Set up diagnostics logs for IoT Hub
- PA0204   Query and visualize tracing by using a platform
- PA0205   Use policy definitions for IoT Hub

Applied Knowledge

- AK0201   Platform language, commands and instructions

Internal Assessment Criteria

- IAC0201   Health monitoring for IoT solutions is configured.

6.2.3   PM-06-PS03   :   Troubleshoot device communication

Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0301   Establish maintenance communication
- PA0302   Verify that device telemetry is received by IoT hub
- PA0303   Validate device twin properties, tags and direct methods
- PA0304   Troubleshoot device disconnects and connects

Applied Knowledge

- AK0301   Platform language, commands and instructions

Internal Assessment Criteria

- IAC0301   Troubleshooting procedures are conducted to identify and resolve defects in device communication

6.2.4   PM-06-PS04   :   Perform end-to-end solution testing and diagnostics

Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0401   Estimate the capacity required for each service in the solution
- PA0402   Conduct performance and stress testing
- PA0403   Work on minor bug fixes

Applied Knowledge

- AK0401   Platform language, commands and instructions

Internal Assessment Criteria

- IAC0401   End-to-end solution testing and diagnostics are performed.

6.3 Provider Programme Accreditation Criteria

Physical Requirements:

- Valid licenses software and application, including OS.

- Internet connection and hardware availability

- Examples and information specified in the scope statement and all the case studies, scenarios and access to hardware and software implied in the scope statements of the modules.

- Remote learners: Provider must provide business IT simulation system (e.g. invoice processing).

Human Resource Requirements:

- Lecturer/learner ratio of 1:10 (Maximum)

- Qualification of lecturer (SME):

    o NQF 6 industry recognised qualification with 1 year's experience in the IT industry

    o Vendor certification

- Assessors and moderators: accredited by the MICT SETA

Legal Requirements:

- Legal (product) licences to use the software for learning and training

- OHS compliance certificate

- Ethical clearance (where necessary)

6.4 Exemptions

- No exemptions, but the module can be achieved in full through a normal RPL process

7. 251201-003-00-PM-07, Implement Security Measures for Internet of Things Solution, NQF Level 4, Credits 10

7.1 Purpose of the Practical Skills Module

The focus of the learning in this module is on providing the learner with an opportunity to acquire the skills to implement security measures for IoT ecosystems

The learner will be required to:

- PM-07-PS01 : Implement device authentication in the IoT Hub
- PM-07-PS02 : Implement device security by using DPS
- PM-07-PS03 : Implement extended detection and response (XDR) solution for threat protection for IoT

7.2 Guidelines for Practical Skills

7.2.1   PM-07-PS01   :   Implement device authentication in the IoT Hub
Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0101   Choose an appropriate form of authentication
- PA0102   Manage certificates for a device
- PA0103   Manage the symmetric keys for a device

Applied Knowledge

- AK0101   Platform language, commands and instructions

Internal Assessment Criteria

- IAC0101   Device authentication is implemented.

7.2.2   PM-07-PS02   :   Implement device security by using DPS
Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0201   Configure different attestation mechanisms with DPS
- PA0202   Generate and manage certificates for IoT Devices
- PA0203   Configure enrolment with certificates
- PA0204   Generate a TPM endorsements key for a device
- PA0205   Configure enrolment with symmetric keys

Applied Knowledge

- AK0201   Platform language, commands and instructions

Internal Assessment Criteria

- IAC0201   Device security by using DPS is implemented.

7.2.3   PM-07-PS03   :   Implement extended detection and response (XDR) solution for threat protection for IoT
Scope of Practical Skill

Given hardware and software and IoT solution requirements, the learner must be able to:

- PA0301   Enable extended detection and response (XDR) solution for threat protection in IoT Hub
- PA0302   Create security modules
- PA0303   Configure custom alerts

Applied Knowledge

- AK0301   Platform language, commands and instructions

Internal Assessment Criteria

- IAC0301   Extended detection and response (XDR) solution for threat protection for IoT is
  implemented

7.3 Provider Programme Accreditation Criteria

Physical Requirements:

- Valid licenses software and application, including OS.

- Internet connection and hardware availability

- Examples and information specified in the scope statement and all the case studies, scenarios and
  access to hardware and software implied in the scope statements of the modules.

- Remote learners: Provider must provide business IT simulation system (e.g. invoice processing).

Human Resource Requirements:

- Lecturer/learner ratio of 1:10 (Maximum)

- Qualification of lecturer (SME):

  o NQF 6 industry recognised qualification with 1 year's experience in the IT industry

  o Vendor certification

- Assessors and moderators: accredited by the MICT SETA

Legal Requirements:

- Legal (product) licences to use the software for learning and training

- OHS compliance certificate

- Ethical clearance (where necessary)

7.4 Exemptions

- No exemptions, but the module can be achieved in full through a normal RPL process

8. 251201-003-00-PM-08, Participate in a Design Thinking for Innovation Workshop, NQF Level 4, Credits 3

8.1 Purpose of the Practical Skills Module

The focus of the learning in this module is on providing the learner with an opportunity to acquire the skills to participate in a design thinking intervention, apply design thinking methodologies and look for opportunities to apply the same methodology in world-of-work and personal life

The learner will be required to:

- PM-08-PS01   :   Collaborate with team members to apply innovative and problem-solving strategies
- PM-08-PS02   :   Apply design thinking process to solve a problem creatively and innovatively

8.2 Guidelines for Practical Skills

8.2.1   PM-08-PS01   :   Collaborate with team members to apply innovative and problem-solving strategies

Scope of Practical Skill

Given access to a Design Thinking workshop with multidisciplinary team members, the learner must be able to:

- PA0101   Interact and collaborate with team members
- PA0102   Engage in dialogues as required by the process
- PA0103   Participate in the activities as presented by the facilitator
- PA0104   Actively contribute to the discussions and activities

Applied Knowledge

- AK0101   Design Thinking as a solution-based approach to solving problems

Internal Assessment Criteria

- IAC0101   The ability to collaborate with team members towards a joint goal is demonstrated

8.2.2   PM-08-PS02   :   Apply design thinking process to solve a problem creatively and innovatively

Scope of Practical Skill

Given access to a Design Thinking workshop with multidisciplinary team members and techniques and equipment, the learner must be able to:

- PA0201   Empathise with users/customers by setting aside own assumptions and formulate real insights about the user
- PA0202   Define the problem statement and create a point-of-view statement, indicating a specific user, a need and an insight
- PA0203   Ideate by challenging assumptions and creating ideas for innovative solutions to help resolve the challenges and needs
- PA0204   Prototype workable ideas
- PA0205   Test the solution applying a reiterative process and using various techniques

Applied Knowledge

- AK0201   Involving five phases: Empathize, Define, Ideate, Prototype and Test

Internal Assessment Criteria

- IAC0201   The ability to participate in the design thinking phases is demonstrated
- IAC0202   Skills are used to understand users, challenge assumptions, redefine problems and create innovative solutions to prototype and test an innovative and creative solution

8.3 Provider Programme Accreditation Criteria

Physical Requirements:

- Valid licenses software and application, including OS.

- Internet connection and hardware availability

- Examples and information specified in the scope statement and all the case studies, scenarios and access to hardware and software implied in the scope statements of the modules.

- Remote learners: Provider must provide business IT simulation system (e.g. invoice processing).

Human Resource Requirements:

- Lecturer/learner ratio of 1:10 (Maximum)

- Qualification of lecturer (SME):

    o   NQF 6 industry recognised qualification with 1 year's experience in the IT industry

    o   Vendor certification

- Assessors and moderators: accredited by the MICT SETA

Legal Requirements:

- Legal (product) licences to use the software for learning and training

- OHS compliance certificate

- Ethical clearance (where necessary)

8.4 Exemptions

- No exemptions, but the module can be achieved in full through a normal RPL process

9. 251201-003-00-PM-09, Function Ethically and Effectively in the Workplace, NQF Level 4, Credits 3

9.1 Purpose of the Practical Skills Module

The focus of the learning in this module is on providing the learner with an opportunity to acquire the skills to function ethically and effectively in the workplace

The learner will be required to:

- PM-09-PS01   :   Present information to an audience
- PM-09-PS02   :   Conduct basic research (gather and explore data and information) on 4IR skills and application opportunities in the workplace
- PM-09-PS03   :   Ensure compliance with the code of conduct and governance in the workplace
- PM-09-PS04   :   Collaborate with team members in the workplace
- PM-09-PS05   :   Attend and participate in meetings

9.2 Guidelines for Practical Skills

9.2.1   PM-09-PS01   : Present information to an audience

Scope of Practical Skill

Given information on an audience and presentation tools, the learner must be able to:

- PA0101   Analyse the audience and research if needed
- PA0102   Select a topic
- PA0103   Define the objective and conduct research on the topic or gather information from an available source
- PA0104   Prepare the content and body of the presentation
- PA0105   Visualise the content using suitable technology
- PA0106   Decide on the method of presentation e.g. story telling
- PA0107   Prepare the introduction and conclusion
- PA0108   Prepare for the presentation
- PA0109   Adapt presentation style to the audience and reaction of the audience
- PA0110   Speak from memory, from notes and from text

Applied Knowledge

- AK0101   Presentation principles
- AK0102   Presentation methods and techniques
- AK0103   Presentation technologies appropriate to the information

Internal Assessment Criteria

- IAC0101   Information is presented using tools, techniques and presentation methods appropriate to the audience

9.2.2   PM-09-PS02   : Conduct basic research (gather and explore data and information) on 4IR skills and application opportunities in the workplace

Scope of Practical Skill

Given access to the internet, the learner must be able to:

- PA0201 Gather and explore information on technologies such as Google, Amazon and MS and identify opportunities to use these tools to improve or reduce development time (e.g. embed AI APIs)
- PA0202 Gather and explore information on business intelligence (BI) applications and availability of Big Data (collecting data, converting data into information and turning information into knowledge, knowledge into intelligence and intelligence into wisdom)

Applied Knowledge

- AK0201 4IR technologies
- AK0202 Impact of 4IR on businesses and individuals

Internal Assessment Criteria

- IAC0201 The application of future skills and competencies in the workplace is researched and opportunities to adapt to the requirements of 4IR are identified

9.2.3 PM-09-PS03   : Ensure compliance with the code of conduct and governance in the workplace

Scope of Practical Skill

Given legislation, industry norms and standards, company policy on governance and code of conduct, the learner must be able to:

- PA0301 Compare company policy with legislation and industry norms and standards to identify any shortfalls or opportunities for improvement
- PA0302 Compare code of conduct with the policy and identify any shortfalls or opportunities for improvement
- PA0303 Compare IT procedures with policy and code of conduct and identify any shortfalls or opportunities for improvement

Applied Knowledge

- AK0301 Ethics: concept and principles
- AK0302 Functions of governance
- AK0303 Compliance vs non-compliance

Internal Assessment Criteria

- IAC0301 Company governance policy and procedures are assessed for compliance with legislation and industry norms and standards

9.2.4 PM-09-PS04   : Collaborate with team members in the workplace

Scope of Practical Skill

Given access to a communication tool (e.g. Agile) and team members, the learner must be able to:

- PA0401 Use technology to communicate and report on progress
- PA0402 Actively collaborate with team members to achieve shared goals
- PA0403 Resolve conflict (if it occurs) using conflict resolution and other interpersonal skills
- PA0404 Apply time management skills and problem solving skills
- PA0405 Achieve goals timeously in support of team goals

Applied Knowledge

- AK0401 Reporting and communication technology

Internal Assessment Criteria

- IAC0401   Management and team members are informed about progress through communication and reporting
- IAC0402   Interpersonal and intrapersonal skills are applied to achieve own and team goals

9.2.5 PM-09-PS05   : Attend and participate in meetings

Scope of Practical Skill

Given role play on meetings, the learner must be able to:

- PA0501   Apply meeting procedures
- PA0502   Prepare the agenda for the meeting
- PA0503   Take notes during the meeting and produce minutes of the meeting
- PA0504   Participate and contribute to the discussions in the meeting

Applied Knowledge

- AK0501   Meeting procedures

Internal Assessment Criteria

- IAC0501   Meeting procedures are observed
- IAC0502   Documentation (agenda and minutes) are produced which give an accurate representation of the agreements

9.3 Provider Programme Accreditation Criteria

Physical Requirements:

- Valid licenses software and application, including OS.

- Internet connection and hardware availability

- Examples and information specified in the scope statement and all the case studies, scenarios and access to hardware and software implied in the scope statements of the modules.

- Remote learners: Provider must provide business IT simulation system (e.g. invoice processing).

Human Resource Requirements:

- Lecturer/learner ratio of 1:10 (Maximum)

- Qualification of lecturer (SME):

  o NQF 6 industry recognised qualification with 1 year's experience in the IT industry

  o Vendor certification

- Assessors and moderators: accredited by the MICT SETA

Legal Requirements:

- Legal (product) licences to use the software for learning and training

- OHS compliance certificate

- Ethical clearance (where necessary)

9.4 Exemptions

- No exemptions, but the module can be achieved in full through a normal RPL process

SECTION 3C: WORK EXPERIENCE MODULE SPECIFICATIONS

List of Work Experience Module Specifications

Work Experience	251201-003-00-WM-01	Internet of Things Solution Deployment Processes	4	15
Work Experience	251201-003-00-WM-02	Data Collecting, Aggregating, Disseminating And Storing Processes	4	15
Work Experience	251201-003-00-WM-03	Data Integration Systems and Processes	4	12

1. 251201-003-00-WM-01, Internet of Things Solution Deployment Processes, NQF Level 4, Credits 15

1.1 Purpose of the Work Experience Module

The focus of the work experience is on providing the learner with an opportunity to:

Assist with the deployment of an IoT solution.

The learner will be required to:

- WM-01-WE01 : Attend induction program and familiarise self with company processes, procedures, tools and culture
- WM-01-WE02 : Shadow and observe an experienced IoT Engineer or Architect undertaking the following tasks
- WM-01-WE03 : Conduct the following tasks under supervision
- WM-01-WE04 : Shadow and observe an experienced IoT Engineer or Architect undertaking the following tasks
- WM-01-WE05 : Conduct the following tasks under supervision
- WM-01-WE06 : Shadow and observe an experienced IoT Engineer or Architect undertaking the following tasks
- WM-01-WE07 : Conduct the following tasks under supervision

1.2 Guidelines for Work Experience

1.2.1 WM-01-WE01 : Attend induction program and familiarize self with company processes, procedures, tools and culture

Scope of Work Experience

The person will be expected to engage in the following work activities:

- WA0101 Attend induction program and familiarise self with the culture of the company
- WA0102 Apply protocols and work etiquette
- WA0103 Attend company specific information sharing sessions (e.g. standing meetings, toolbox talks, power hours, etc.)
- WA0104 Familiarise self with and apply "working from anywhere" protocols
- WA0105 Read and understand company IoT management and security policy, protocols and procedures
- WA0106 Comply with governance protocols and code of ethics of the company and ensure legal compliance by adhering to legal requirements (incl. but not limited to privacy, confidentiality, security of data, etc.)
- WA0107 Spend time in the various departments of the company, observe process flows and compile wire diagrams or workflow of the processes observed using suitable tools and showing the relationships and influences each of the departments have on each other
- WA0108 Indicate employment of IoT solutions related to the workflow functions
- WA0109 Understand management requirements and expectations from IoT solutions
- WA0110 Understand IoT solution protocols and procedures
- WA0111 Understand company deployment of IoT solutions
- WA0112 Manage timesheets and apply self-management skills
- WA0113 Collaborate with team members to achieve common and individual goals

Supporting Evidence

- SE0101 Attendance registers
- SE0102 Wire diagrams or workflows

1.2.2 WM-01-WE02 : Shadow and observe an experienced IoT Engineer or Architect undertaking the following tasks:

Scope of Work Experience

The person will be expected to engage in the following work activities:

- WA0201   Design a suitable IoT platform architecture and identify critical data entities for a simple IoT solution
- WA0202   Design robust, maintainable high-performance IoT systems
- WA0203   Connect and establish communication with a sensor
- WA0204   Create and configure an IoT Hub
- WA0205   Build device messaging and communication
- WA0206   Configure physical IoT devices
- WA0207   Set up and deploy an IoT Edge device
- WA0208   Develop modules
- WA0209   Configure an IoT Edge device

Supporting Evidence

- SE0201   Design
- SE0202   Logs

1.2.3 WM-01-WE03 : Conduct the following tasks under supervision

Scope of Work Experience

The person will be expected to engage in the following work activities:

- WA0301   Design a suitable IoT platform architecture and identify critical data entities for a simple IoT solution
- WA0302   Design robust, maintainable high-performance IoT systems
- WA0303   Connect and establish communication with a sensor
- WA0304   Create and configure an IoT Hub
- WA0305   Build device messaging and communication
- WA0306   Configure physical IoT devices
- WA0307   Set up and deploy an IoT Edge device
- WA0308   Develop modules
- WA0309   Configure an IoT Edge device

Supporting Evidence

- SE0301   Design
- SE0302   Logs

1.2.4 WM-01-WE04 : Shadow and observe an experienced IoT Engineer or Architect undertaking the following tasks

Scope of Work Experience

The person will be expected to engage in the following work activities:

- WA0401   Implement the Device Provisioning Service (DPS)

- WA0402   Manage the device lifecycle

- WA0403   Manage IoT devices by using IoT Hub

- WA0404   Build a solution by using IoT Central

Supporting Evidence

- SE0401   Logs

1.2.5   WM-01-WE05   :   Conduct the following tasks under supervision
Scope of Work Experience

The person will be expected to engage in the following work activities:

- WA0501   Implement the Device Provisioning Service (DPS)

- WA0502   Manage the device lifecycle

- WA0503   Manage IoT devices by using IoT Hub

- WA0504   Build a solution by using IoT Central

Supporting Evidence

- SE0501   Logs

1.2.6   WM-01-WE06   :   Shadow and observe an experienced IoT Engineer or Architect undertaking the following tasks
Scope of Work Experience

The person will be expected to engage in the following work activities:

- WA0601   Design an approach for device management
- WA0602   Configure IoT health monitoring
- WA0603   Troubleshoot device communication
- WA0604   Perform end-to-end solution testing and diagnostics
- WA0605   Implement device authentication in the IoT Hub
- WA0606   Implement device security by using DPS
- WA0607   Implement extended detection and response (XDR) solution for threat protection for IoT

Supporting Evidence

- SE0601   Logs

1.2.7   WM-01-WE07   :   Conduct the following tasks under supervision
Scope of Work Experience

The person will be expected to engage in the following work activities:

- WA0701   Design an approach for device management

- WA0702   Configure IoT health monitoring
- WA0703   Troubleshoot device communication
- WA0704   Perform end-to-end solution testing and diagnostics
- WA0705   Implement device authentication in the IoT Hub
- WA0706   Implement device security by using DPS
- WA0707   Implement extended detection and response (XDR) solution for threat protection for IoT

Supporting Evidence

- SE0701   Logs

1.3 Contextualised Workplace Knowledge

1. Organisational policies, procedures and guidelines which relate to cybersecurity.
2. Standard templates, documentation and tools.
3. Business processes and workflows pertaining to IoT deployment.
4. Team members.
5. Company specific operating systems.
6. Vendor specific IoT tools and platforms.
7. Company specific best practices, quality standards and security protocols.
8. Version control system.
9. Sources of information available.
10. Approval process.

1.4 Criteria for Workplace Approval

Physical Requirements:

- Tools, equipment, systems, e.g.: End-to-end IoT system architecture

- Key processes, e.g.: User specifications (output expected), data collection processes from devices or sensors, data querying and data visualisation.

Human Resource Requirements:

- Maximum mentor/learner ratio of 1:3 in the ideal situation

- Supervisor/mentor: 2 years' software development experience

Legal Requirements:

- Legal (product) licences to use software

- OHS compliance certificate

- Ethical clearance (where necessary)

1.5 Additional Assignments to be Assessed Externally

None

2. 251201-003-00-WM-02, Data Collecting, Aggregating, Disseminating and Storing Processes, NQF Level 4, Credits 15

2.1 Purpose of the Work Experience Module

The focus of the work experience is on providing the learner with an opportunity to:

Accurately collect, aggregate, disseminate and store large amounts of unstructured and structured data generated by these devices.

The learner will be required to:

- WM-02-WE01 : Shadow and observe an experienced IoT Engineer or Architect undertaking the following tasks
- WM-02-WE02 : Conduct the following tasks under supervision
- WM-02-WE03 : Shadow and observe an experienced IoT Engineer or Architect undertaking the following tasks
- WM-02-WE04 : Conduct the following tasks under supervision

2.2 Guidelines for Work Experience

2.2.1 WM-02-WE01 : Shadow and observe an experienced IoT Engineer or Architect undertaking the following tasks

Scope of Work Experience

The person will be expected to engage in the following work activities:

- WA0101 Configure routing in IoT Hub
- WA0102 Configure stream processing
- WA0103 Configure an IoT solution for Time Series Insights (TSI)
- WA0104 Integrate collected data with the existing enterprise resource planning (ERP) systems for consumption and use

Supporting Evidence

- SE0101 Logs

2.2.2 WM-02-WE02 : Conduct the following tasks under supervision

Scope of Work Experience

The person will be expected to engage in the following work activities:

- WA0201 Configure routing in IoT Hub
- WA0202 Configure stream processing
- WA0203 Configure an IoT solution for Time Series Insights (TSI)
- WA0204 Integrate collected data with the existing enterprise resource planning (ERP) systems for consumption and use

Supporting Evidence

- SE0201 Logs

2.2.3 WM-02-WE03 : Shadow and observe an experienced IoT Engineer or Architect undertaking the following tasks

Scope of Work Experience

The person will be expected to engage in the following work activities:

- WA0301   Report data
- WA0302   Summarise and format data using tables
- WA0303   Create, use and edit pivot tables and pivot charts
- WA0304   Create, use and edit dashboards
- WA0305   Create and configure hierarchies and time data
- WA0306   Apply a data model
- WA0307   Import data from files
- WA0308   Import data from databases
- WA0309   Import data from reports
- WA0310   Visualize data

Supporting Evidence

- SE0301   Logs

2.2.4   WM-02-WE04   :   Conduct the following tasks under supervision
Scope of Work Experience

The person will be expected to engage in the following work activities:

- WA0401   Report data
- WA0402   Summarise and format data using tables
- WA0403   Create, use and edit pivot tables and pivot charts
- WA0404   Create, use and edit dashboards
- WA0405   Create and configure hierarchies and time data
- WA0406   Apply a data model
- WA0407   Import data from files
- WA0408   Import data from databases
- WA0409   Import data from reports
- WA0410   Visualize data

Supporting Evidence

- SE0401   Logs

2.3 Contextualised Workplace Knowledge

1. Organisational policies, procedures and guidelines which relate to cybersecurity.
2. Standard templates, documentation and tools.
3. Business processes and workflows pertaining to IoT deployment.
4. Team members.
5. Company specific operating systems.
6. Vendor specific IoT tools and platforms.
7. Company specific best practices, quality standards and security protocols.
8. Version control system.
9. Sources of information available.
10. Approval process.

2.4 Criteria for Workplace Approval

Physical Requirements:

- Tools, equipment, systems, e.g.: End-to-end IoT system architecture

- Key processes, e.g.: User specifications (output expected), data collection processes from devices or sensors, data querying and data visualisation.

Human Resource Requirements:

- Maximum mentor/learner ratio of 1:3 in the ideal situation

- Supervisor/mentor: 2 years' software development experience

Legal Requirements:

- Legal (product) licences to use software

- OHS compliance certificate

- Ethical clearance (where necessary)

2.5 Additional Assignments to be Assessed Externally

None

3. 251201-003-00-WM-03, Data Integration Systems and Processes, NQF Level 4, Credits 12

3.1 Purpose of the Work Experience Module

The focus of the work experience is on providing the learner with an opportunity to:

Integrate collected data with the existing systems such as enterprise resource planning (ERP) of an organisation for consumption and use

The learner will be required to:

- WM-03-WE01   :   Shadow and observe an experienced IoT Engineer or Architect undertaking the following tasks
- WM-03-WE02   :   Conduct the following tasks under supervision

3.2 Guidelines for Work Experience

3.2.1   WM-03-WE01   :   Shadow and observe an experienced IoT Engineer or Architect undertaking the following tasks

Scope of Work Experience

The person will be expected to engage in the following work activities:

- WA0101   Use middleware and API platforms for data exchange and integration using the following tasks:
  - Make changes to the request and response objects
  - End the request-response cycle
  - Call the nest middleware function in the stack
- WA0102   Clean up data before integration
- WA0103   Analyse integration requirements
- WA0104   Use a middleware integration tool
- WA0105   Enable data to exchange between e.g., ERP systems to other applications using API request and response commands
- WA0106   Monitor API functionality and seamless transfer of data

Supporting Evidence

- SE0101   Logs

3.2.2   WM-03-WE02   :   Conduct the following tasks under supervision

Scope of Work Experience

The person will be expected to engage in the following work activities:

- WA0201   Use middleware and API platforms for data exchange and integration
- WA0202   Clean up data before integration
- WA0203   Analyse integration requirements
- WA0204   Use a middleware integration tool
- WA0205   Enable data to exchange between e.g. ERP systems to other applications using API request and response commands.
- WA0206   Monitor API functionality and seamless transfer of data

Supporting Evidence

- SE0201   Logs

3.3 Contextualised Workplace Knowledge

1. Organisational policies, procedures and guidelines which relate to cybersecurity.
2. Standard templates, documentation and tools.
3. Business processes and workflows pertaining to IoT deployment.
4. Team members.
5. Company specific operating systems.
6. Vendor specific IoT tools and platforms.
7. Company specific best practices, quality standards and security protocols.
8. Version control system.
9. Sources of information available.
10. Approval process.

3.4 Criteria for Workplace Approval

Physical Requirements:

- Tools, equipment, systems, e.g.: End-to-end IoT system architecture

- Key processes, e.g.: User specifications (output expected), data collection processes from devices or sensors, data querying and data visualisation.

Human Resource Requirements:

- Maximum mentor/learner ratio of 1:3 in the ideal situation

- Supervisor/mentor: 2 years' software development experience

Legal Requirements:

- Legal (product) licences to use software

- OHS compliance certificate

- Ethical clearance (where necessary)

3.5 Additional Assignments to be Assessed Externally

None

SECTION 4: STATEMENT OF WORK EXPERIENCE

Curriculum Number:	251201003
Curriculum Title:	Internet of Things Developer

Learner Details	
Name:	
ID Number:	

Employer Details	
Company Name:	
Address:	
Supervisor Name:	
Work Telephone:	
E-Mail:	

251201003-WM-01, IoT Solution Deployment Processes, NQF Level 4, Credits 15

WM-01-WE01	Attend induction program and familiarise self with company processes, procedures, tools and culture		
	Scope of Work Experience	Date	Signature
WA0101	Attend induction program and familiarise self with the culture of the company.		
WA0102	Apply protocols and work etiquette.		
WA0103	Attend company specific information sharing sessions (e.g. standing meetings, toolbox talks, power hours, etc.)		
WA0104	Familiarise self with and apply "working from anywhere" protocols.		
WA0105	Read and understand company IoT management and security policy, protocols and procedures.		
WA0106	Comply with governance protocols and code of ethics of the company and ensure legal compliance by adhering to legal requirements (incl. but not limited to privacy, confidentiality, security of data, etc.).		
WA0107	Spend time in the various departments of the company, observe process flows and compile wire diagrams or workflow of the processes observed using suitable tools and showing the relationships and influences each of the departments have on each other.		
WA0108	Indicate employment of IoT solutions related to the workflow functions.		
WA0109	Understand management requirements and expectations from IoT solutions.		
WA0110	Understand IoT solutions protocols and procedures.		
WA0111	Understand company deployment of IoT solutions.		
WA0112	Manage timesheets and apply self-management skills.		
WA0113	Collaborate with team members to achieve common and individual goals		
	Supporting Evidence	Date	Signature

SE0101	Attendance registers		
SE0102	Wire diagrams or workflows		
WM-01-WE02	Shadow and observe an experienced IoT Engineer or Architect undertaking the following tasks:		
	Scope of Work Experience	Date	Signature
WA0201	Design a suitable IoT platform architecture and identify critical data entities for a simple IoT solution		
WA0202	Design robust, maintainable high-performance IoT systems		
WA0203	Connect and establish communication with a sensor		
WA0204	Create and configure an IoT Hub		
WA0205	Build device messaging and communication		
WA0206	Configure physical IoT devices		
WA0207	Set up and deploy an IoT Edge device		
WA0208	Develop modules		
WA0209	Configure an IoT Edge device		
	Supporting Evidence	Date	Signature
SE0201	Logs		
WM-01-WE03	Conduct the following tasks under supervision		
	Scope of Work Experience	Date	Signature
WA0301	Design a suitable IoT platform architecture and identify critical data entities for a simple IoT solution		
WA0302	Design robust, maintainable high-performance IoT systems		
WA0303	Connect and establish communication with a sensor		

WA0304	Create and configure an IoT Hub		
WA0305	Build device messaging and communication		
WA0306	Configure physical IoT devices		
WA0307	Set up and deploy an IoT Edge device		
WA0308	Develop modules		
WA0309	Configure an IoT Edge device		
	Supporting Evidence	Date	Signature
SE0301	Logs		
WM-01-WE04	Shadow and observe an experienced IoT Engineer or Architect undertaking the following tasks:		
	Scope of Work Experience	Date	Signature
WA0401	Implement the Device Provisioning Service (DPS)		
WA0402	Manage the device lifecycle		
WA0403	Manage IoT devices by using IoT Hub		
WA0404	Build a solution by using IoT Central		
	Supporting Evidence	Date	Signature
SE0401	Logs		
WM-01-WE05	Conduct the following tasks under supervision		
	Scope of Work Experience	Date	Signature
WA0501	Implement the Device Provisioning Service (DPS)		

WA0502	Manage the device lifecycle		
WA0503	Manage IoT devices by using IoT Hub		
WA0504	Build a solution by using IoT Central		
	Supporting Evidence	Date	Signature
SE0501	Logs		
WM-01-WE06	Shadow and observe an experienced IoT Engineer or Architect undertaking the following tasks:		
	Scope of Work Experience	Date	Signature
WA0601	Design an approach for device management		
WA0602	Configure IoT health monitoring		
WA0603	Troubleshoot device communication		
WA0604	Perform end-to-end solution testing and diagnostics		
WA0605	Implement device authentication in the IoT Hub		
WA0606	Implement device security by using DPS		
WA0607	Implement extended detection and response (XDR) solution for threat protection for IoT		
	Supporting Evidence	Date	Signature
SE0601	Logs		
WM-01-WE07	Conduct the following tasks under supervision		
	Scope of Work Experience	Date	Signature
WA0701	Design an approach for device management		

WA0702	Configure IoT health monitoring		
WA0703	Troubleshoot device communication		
WA0704	Perform end-to-end solution testing and diagnostics		
WA0705	Implement device authentication in the IoT Hub		
WA0706	Implement device security by using DPS		
WA0707	Implement extended detection and response (XDR) solution for threat protection for IoT		
	Supporting Evidence	Date	Signature
SE0701	Logs		

	Contextualised Workplace Knowledge	Date	Signature

	Additional Assignments to be Assessed Externally	Date	Signature

251201003-WM-02, Data Collecting, Aggregating, Disseminating And Storing Processes, NQF Level 4, Credits 15

WM-02-WE01	Shadow and observe an experienced IoT Engineer or Architect undertaking the following tasks:		
	Scope of Work Experience	Date	Signature
WA0101	Configure routing in IoT Hub		
WA0102	Configure stream processing		

WA0103	Configure an IoT solution for Time Series Insights (TSI)		
WA0104	Integrate collected data with the existing enterprise resource planning (ERP) systems for consumption and use.		
	Supporting Evidence	Date	Signature
SE0101			
WM-02-WE02	Conduct the following tasks under supervision		
	Scope of Work Experience	Date	Signature
WA0201	Configure routing in IoT Hub		
WA0202	Configure stream processing		
WA0203	Configure an IoT solution for Time Series Insights (TSI)		
WA0204	Integrate collected data with the existing enterprise resource planning (ERP) systems for consumption and use.		
	Supporting Evidence	Date	Signature
SE0201			
WM-02-WE03	Shadow and observe an experienced IoT Engineer or Architect undertaking the following tasks:		
	Scope of Work Experience	Date	Signature
WA0301	Report data		
WA0302	Summarise and format data using tables		
WA0303	Create, use and edit pivot tables and pivot charts		
WA0304	Create, use and edit dashboards		
WA0305	Create and configure hierarchies and time data		
WA0306	Apply a data model		

WA0307	Import data from files		
WA0308	Import data from databases		
WA0309	Import data from reports		
WA0310	Visualize data		
	Supporting Evidence	Date	Signature
SE0301			
SE0302			
WM-02-WE04	Conduct the following tasks under supervision		
	Scope of Work Experience	Date	Signature
WA0401	Report data		
WA0402	Summarise and format data using tables		
WA0403	Create, use and edit pivot tables and pivot charts		
WA0404	Create, use and edit dashboards		
WA0405	Create and configure hierarchies and time data		
WA0406	Apply a data model		
WA0407	Import data from files		
WA0408	Import data from databases		
WA0409	Import data from reports		
WA0410	Visualize data		
	Supporting Evidence	Date	Signature
SE0401			
SE0402			

	Contextualised Workplace Knowledge	Date	Signature

	Additional Assignments to be Assessed Externally	Date	Signature

251201003-WM-03, Data Integration Systems and Processes, NQF Level 4, Credits 12

WM-03-WE01	Shadow and observe an experienced IoT Engineer or Architect undertaking the following tasks:		
	Scope of Work Experience	Date	Signature
WA0101	Use middleware and API platforms for data exchange and integration using the following tasks:		
	Make changes to the request and response objects		
	End the request-response cycle		
	Call the nest middleware function in the stack		
WA0102	Clean up data before integration		
WA0103	Analyse integration requirements		
WA0104	Use a middleware integration tool		
WA0105	Enable data to exchange between e.g. ERP systems to other applications using API request and response commands.		
WA0106	Monitor API functionality and seamless transfer of data.		
	Supporting Evidence	Date	Signature
SE0101			

		Date	Signature
SE0102			
WM-03-WE02	Conduct the following tasks under supervision		
	Scope of Work Experience	Date	Signature
WA0201	Use middleware and API platforms for data exchange and integration		
WA0202	Clean up data before integration		
WA0203	Analyse integration requirements		
WA0204	Use a middleware integration tool		
WA0205	Enable data to exchange between e.g. ERP systems to other applications using API request and response commands.		
WA0206	Monitor API functionality and seamless transfer of data.		
	Supporting Evidence	Date	Signature
SE0201			

	Contextualised Workplace Knowledge	Date	Signature

	Additional Assignments to be Assessed Externally	Date	Signature