


Skills Programme Curriculum Document		
Curriculum Code	Curriculum Title	
900100-000-00-00	Fifth Generation (5G) Cellular Network Administrator	

## Table of content

SECTION 1: SKILLS PROGRAMME CURRICULUM SUMMARY .....	3
1. Skills Programme Information .....	3
2. Curriculum Information .....	3
SECTION 2: SKILLS PROGRAMME PROFILE .....	5
1. Skills Programme Purpose .....	5
2. Skills Programme Tasks .....	5
3. Skills Programme Task Details .....	5
SECTION 3: SKILLS PROGRAMME COMPONENT SPECIFICATIONS .....	6
SECTION 3A: KNOWLEDGE/THEORY MODULE SPECIFICATIONS .....	6
1. 900100-000-00-KM-01, Introduction to 5G, NQF Level 4, Credits 3 .....	7
2. 900100-000-00-KM-02, 5G Core Network, NQF Level 4, Credits 10 .....	10
3. 900100-000-00-KM-03, Fundamentals of 5G Technology, NQF Level 4, Credits 8 .....	15
4. 900100-000-00-KM-04, 5G Infrastructure, NQF Level 4, Credits 8 .....	19
5. 900100-000-00-KM-05, Performances, Services and Applications, NQF Level 4, Credits 4 .....	22
SECTION 3B: APPLICATION MODULE SPECIFICATIONS .....	25
1. 900100-000-00-PM-01, Set Up a Workstation and User Account in a NOC, NQF Level 4, Credits 4 .....	26
2. 900100-000-00-PM-02, Monitor 5G Cellular Network Performance, NQF Level 4, Credits 18 .....	30
3. 900100-000-00-PM-03, Troubleshoot and Solve 5G Network Related Problems, NQF Level 4, Credits 4 .....	33

## **SECTION 1: SKILLS PROGRAMME CURRICULUM SUMMARY**

### **1. Skills Programme Information**

#### **1.1 Skills Addressed by this Curriculum**

- Fifth Generation (5G) Cellular Network Administrator, NQF Level 4, Credits 16

#### **1.2 Skills Programme Entry Requirements**

- Matric with Math Lit and Communication and computer science; or
- TVET equivalent or
- Grade 11 with Math Lit with 3 years' experience in the telecommunication environment

#### **1.3 Associated Occupations**

- Systems Administrator
- Network Administrator

#### **1.4 Registered Related Qualifications**

- (SAQA QUAL ID: 78965) Further Education and Training Certificate: Telecommunication Network Operations, NQF Level 4

## **2. Curriculum Information**

### **2.1 Curriculum Structure**

This Skills Programme consist of two components namely Knowledge/Theory component and Application component. The following are compulsory modules in each of the two components:

#### **2.1.1. Knowledge/Theory Component:**

The following Modules are compulsory:

- 900100-000-00-KM-01, Introduction to 5G, NQF Level 4, Credits 3
- 900100-000-00-KM-02, 5G Core Network, NQF Level 4, Credits 10
- 900100-000-00-KM-03, Fundamentals of 5G Technology, NQF Level 4, Credits 8
- 900100-000-00-KM-04, 5G Infrastructure, NQF Level 4, Credits 8
- 900100-000-00-KM-05, Performances, services and applications, NQF Level 4, Credits 4

Total number of credits for Knowledge Component: 33

#### **2.1.2. Application Component:**

- 900100-000-00-PM-01, Set up a workstation and a user account in a NOC, NQF Level 4, Credits 4
- 900100-000-00-PM-02, Monitor 5G cellular network performance, NQF Level 4, Credits 18
- 900100-000-00-PM-03, Troubleshoot and solve 5G network related problems, NQF Level 4, Credits 4

Total number of credits for Application Component: 26

## 2.2 Skills Development Provider Accreditation Requirements

### *Physical Requirements:*

- Valid licensed 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.
- Learning platform/toolkit with relevant exercises and simulations.

### *Human Resource Requirements:*

- Qualification of lecturer (SME):
  - NQF 5 industry recognised qualification with 1 years' 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)

## **SECTION 2: SKILLS PROGRAMME PROFILE**

### **1. Skills Programme Purpose**

A Fifth Generation (5G) Cellular Network Administrator maintains and supports the optimal performance and security of 5G cellular networks in a network operations centre (NOC) to monitor operations of complex networking environments that require high availability

### **2. Skills Programme Tasks**

- Carry out support functions in 5G cellular network operation centres as designed and planned by the senior engineer (NQF Level 4)
- Execute performance monitoring of 5G cellular networks (NQF Level 4)
- Diagnose and repair faults (NQF Level 4)

### **3. Skills Programme Task Details**

#### **3.1. Carry out support functions in 5G cellular network operation centres as designed and planned by the senior engineer (NQF Level 4)**

##### **Unique Product or Service:**

- Support functions in 5G cellular network operation centres

##### **Occupational Responsibilities:**

- Set up a workstation and an user account in a NOC

#### **3.2 Execute performance monitoring of 5G cellular networks (NQF Level 4)**

##### **Unique Product or Service:**

- Performance monitored and maintained

##### **Occupational Responsibilities:**

- Monitor 5G cellular network performance by responding to dashboard information and alerts

#### **3.3. Diagnose and repair faults (NQF Level 4)**

##### **Unique Product or Service:**

- Troubleshooting and problem solving

##### **Occupational Responsibilities:**

- Troubleshoot and solve 5G cellular network related problems

## **SECTION 3: SKILLS PROGRAMME COMPONENT SPECIFICATIONS**

### **SECTION 3A: KNOWLEDGE/THEORY MODULE SPECIFICATIONS**

The following modules are compulsory:

- 900100-000-00-KM-01, Introduction to 5G, NQF Level 4, Credits 3
- 900100-000-00-KM-02, 5G Core Network, NQF Level 4, Credits 10
- 900100-000-00-KM-03, Fundamentals of 5G Technology, NQF Level 4, Credits 8
- 900100-000-00-KM-04, 5G Infrastructure, NQF Level 4, Credits 8
- 900100-000-00-KM-05, Performances, services and applications, NQF Level 4, Credits 4

## 1. 900100-000-00-KM-01, Introduction to 5G, NQF Level 4, Credits 3

### 1.1 Purpose of the Knowledge Module

The main focus of the learning in this knowledge module is to build an understanding of 5G cellular networks and ecosystems.

The learning will enable learners to demonstrate an understanding of:

- KM-01-KT01 : 5G ecosystem **20%**
- KM-01-KT02 : Stakeholders **20%**
- KM-01-KT03 : 5G era **20%**
- KM-01-KT04 : 5G deployment options **20%**
- KM-01-KT05 : Use cases and application of 5G (will change as it evolves: transport and automation, agriculture) **20%**

### 1.2 Guidelines for Topics

- 1.2.1. KM-01-KT01 : 5G ecosystem **20%****

**Topic elements to be covered include:**

- KT0101 Growing demand
- KT0102 Governance
- KT0103 International technical standards
- KT0104 Regulatory frameworks
- KT0105 5G 3GPP standards (3rd Generation Partnership Project)
- KT0106 Security and cyber resilience

**Internal Assessment Criteria and Weight**

- IAC0101 The growing demand for 5G is discussed.
- IAC0102 The role and purpose of international technical standards are evaluated.
- IAC0103 The role and purpose of regulatory frameworks are evaluated.
- IAC0104 The aim of the 3GPP is explained.
- IAC0105 Potential impact of 5G on economies is reasoned.
- IAC0106 The importance of security and cyber resilience is stated and how 5G supports these is reasoned.

**(Weight 20%)**

- 1.2.2. KM-01-KT02 : Stakeholders **20%****

**Topic elements to be covered include:**

- KT0201 Mobile network operators
- KT0202 Equipment vendors
- KT0203 Industry stakeholders
- KT0204 Users

**Internal Assessment Criteria and Weight**

- IAC0201 The roles and functions of the respective stakeholders are identified.
- IAC0202 Stakeholder expectations are clarified.

**(Weight 20%)**

**1.2.3. KM-01-KT03 : 5G era 20%**

**Topic elements to be covered include:**

- KT0301 The 5G age
- KT0302 Evolution of mobile generations
- KT0303 History of 5G
- KT0304 Characteristics: boundless connectivity for all and intelligent automation
- KT0305 Advantages and disadvantages
- KT0306 Transformation of industrial processes

**Internal Assessment Criteria and Weight**

- IAC0301 The mobile wireless evolution progression is mapped, demonstrating the deployment and advances in efficiency and performance.

**(Weight 20%)**

**1.2.4. KM-01-KT04 : 5G deployment options 20%**

**Topic elements to be covered include:**

- KT0401 Add-on to 4G – non-standalone (NSA)
- KT0402 5G only i.e., standalone (SA)
- KT0403 5G Core deployment
- KT0404 Misinformation and controversy

**Internal Assessment Criteria and Weight**

- IAC0401 5G deployment options are described in terms of advantages and disadvantages.

**(Weight 20%)**

**1.2.5. KM-01-KT05 : Use cases and application of 5G (will change as it evolves: transport and automation, agriculture) 20%**

**Topic elements to be covered include:**

- KT0501 Telecommunications
- KT0502 Media and entertainment
- KT0503 Automotive and transportation
- KT0504 Manufacturing, Industrial automation and IoT
- KT0505 Public services
- KT0506 Agriculture (NOC equivalent managing the technology and the flow of information (from receiving data from sensors to data scientist))

**Internal Assessment Criteria and Weight**



- IAC0501 The impact of 5G deployment in the respective use cases is reasoned.
- IAC0502 Potential growth and evolving of 5G are described.

**(Weight 20%)**

### **1.3 Provider Programme Accreditation Criteria**

*Physical Requirements:*

- Valid licensed 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.
- Learning platform/toolkit with relevant exercises and simulations.

*Human Resource Requirements:*

- Qualification of lecturer (SME):
  - NQF 5 industry recognised qualification with 1 years' 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)

### **1.4 Exemptions**

- RPL based

## 2. 900100-000-00-KM-02, 5G Core Network, NQF Level 4, Credits 10

### 2.1 Purpose of the Knowledge Module

The main focus of the learning in this knowledge module is to build an understanding of 5G core network technology and how it is different from 4G.

The learning will enable learners to demonstrate an understanding of:

- KM-02-KT01 : 5G Core Network technology **10%**
- KM-02-KT02 : Design of 5G core network **15%**
- KM-02-KT03 : 5GC (5G core network) **25%**
- KM-02-KT04 : 5G Signalling in 5G Core **10%**
- KM-02-KT05 : Creating a 5G NR air interface between 5G base station and smart devices **10%**
- KM-02-KT06 : Network Operations Centre (NOC) **15%**
- KM-02-KT07 : Computer skills and understanding dashboards **15%**

### 2.2 Guidelines for Topics

#### 2.2.1. KM-02-KT01 : 5G Core Network technology **10%**

**Topic elements to be covered include:**

- KT0101 Transport networks
- KT0102 RAN
- KT0103 Mobile core
- KT0104 Coordination between the RAN, the mobile core networks and the transport network
- KT0105 Increased deployed radio sites

#### **Internal Assessment Criteria and Weight**

- IAC0101 5G Core Network technology is identified and mapped in terms of how it connects.
- IAC0102 The impact of the demand from the increased radio site deployment is evaluated.
- IAC0103 The importance of 5G Core in the 5G ecosystem is justified.

**(Weight 10%)**

#### 2.2.2. KM-02-KT02 : Design of 5G core network **15%**

**Topic elements to be covered include:**

- KT0201 3GPP (Third Generation Partnership Project) standard development
- KT0202 Advantages of 5G technologies (speed, capacity, lower latency, range, error rate)
- KT0203 Layers
  - Network layer
  - Controller layer
  - Management and orchestration layer
  - Service layer
- KT0204 Flexibility and reconfigurability
- KT0205 Network elements
- KT0206 Design requirements: the range of applications requires data to travel distances, large data volumes, or some combination

### **Internal Assessment Criteria and Weight**

- IAC0201 Design aspects of 5G core network are identified and described in terms of functions and connectivity

**(Weight 15%)**

#### **2.2.3. KM-02-KT03 : 5GC (5G core network)**

**25%**

**Topic elements to be covered include:**

- KT0301 Primary components of the 5G System, also known as 5GS
  - 5G core network
  - 5G Access network (5G-AN)
  - User Equipment (UE)
- KT0302 The 5G core uses a cloud-aligned service-based architecture (SBA) to support authentication, security, session management and aggregation of traffic from connected devices
- KT0303 Requiring the complex interconnection of network functions
- KT0304 The components of the 5G core architecture include:
  - User plane Function (UPF)
  - Data network (DN), e.g. operator services, Internet access or 3rd party services
  - Core Access and Mobility Management Function (AMF)
  - Authentication Server Function (AUSF)
  - Session Management Function (SMF)
  - Network Slice Selection Function (NSSF)
  - Network Exposure Function (NEF)
  - NF Repository Function (NRF)
  - Policy Control function (PCF)
  - Unified Data Management (UDM)
  - Application Function (AF)
- KT0305 How it works: more complex behind the scenes
  - User Equipment (UE) (like 5G smartphones or 5G cellular devices) connects over the 5G New Radio Access Network to the 5G core and further to Data Networks (DN) (like the Internet)
  - The Access and Mobility Management Function (AMF) acts as a single-entry point for the UE connection
  - Based on the service requested by the UE, the AMF selects the respective Session Management Function (SMF) for managing the user session
  - The User Plane Function (UPF) transports the IP data traffic (user plane) between the User Equipment (UE) and the external networks
  - The Authentication Server Function (AUSF) allows the AMF to authenticate the UE and to access services of the 5G core

- Other functions like the Session Management Function (SMF), the Policy Control Function (PCF), the Application Function (AF) and the Unified Data Management (UDM) function provide the policy control framework, applying policy decisions and accessing subscription information, to govern the network behaviour

**Internal Assessment Criteria and Weight**

- IAC0301 Primary components of the 5GS are explained in terms of their respective functions.
- IAC0302 The function of the SBA is explained with examples.
- IAC0303 Components of the 5G core architecture are stated.
- IAC0304 A flow chart of the complex functioning of the 5GC is compiled to show the complex connectivity between components.

**(Weight 25%)**

**2.2.4. KM-02-KT04 : 5G Signalling in 5G Core 10%**

**Topic elements to be covered include:**

- KT0401 Introduction to mobile signalling
- KT0402 The evolution of mobile signalling in 2G/4G/4G/5G
- KT0403 Main items of 5G signalling
- KT0404 Network functions:
  - Managing signal and traffic
  - Maintaining integrity and security
  - Enabling the design of differentiated services
  - Helping with better utilisation of network resources

**Internal Assessment Criteria and Weight**

- IAC0401 5G signalling concepts are defined.

**(Weight 10%)**

**2.2.5. KM-02-KT05 : Creating a 5G NR air interface between 5G base station and smart devices 10%**

**Topic elements to be covered include:**

- KT0501 Variety of spectrum
- KT0502 Massive MIMO
- KT0503 Flexible frame structure
- KT0504 Flexible OFDM numerologies (orthogonal frequency-division multiplexing (OFDM) is a type of digital transmission and a method of encoding digital data on multiple carrier frequencies)
- KT0505 Advanced channel coding
- KT0506 Multi-RAT (radio access technologies) connectivity

**Internal Assessment Criteria and Weight**

- IAC0501 5G NR air interface concepts are defined.
- IAC0502 Functions and characteristics of 5G NR air interface elements are stated.

**(Weight 10%)**

**2.2.6. KM-02-KT06 : Network Operations Centre (NOC)**

**15%**

**Topic elements to be covered include:**

- KT0601 Layout
- KT0602 Equipment and hardware
- KT0603 Toolkits (vendor specific)
- KT0604 How does a NOC work?
- KT0605 Handling wide variety of essential functions in the mobile network:
  - Connectivity and mobility management
  - Authentication and authorization
  - Subscriber data management
  - Policy management
  - Other
- KT0606 Roles and responsibilities of staff
- KT0607 Operating procedures
- KT0608 Communication with technicians

**Internal Assessment Criteria and Weight**

- IAC0601 NOC is defined and respective components are identified.
- IAC0602 The main functions of the NOC are identified and described.
- IAC0603 The roles and responsibilities of the types of staff members are briefly explained.
- IAC0604 The functions of the main operating procedures are explained.

**(Weight 15%)**

**2.2.7. KM-02-KT07 : Computer skills and understanding dashboards**

**15%**

**Topic elements to be covered include:**

- KT0701 Vendor specific toolkits
- KT0702 Utilisation of hardware and software
- KT0703 NOC dashboards (operations dashboard and notifications dashboard)
- KT0704 Function of the NOC dashboard
- KT0705 Various views and functionalities
- KT0706 Navigating between functionalities
- KT0707 Tracking tasks
- KT0708 Reading technical information from the dashboard: gauges, graphs, alerts
- KT0709 Metric
- KT0710 Confidence levels
- KT0711 Data visualisation

- KT0712 Units of measurement (e.g. latency is measured using TCP packets)

**Internal Assessment Criteria and Weight**

- IAC0701 An understanding of the functions of vendor specific toolkits is demonstrated.
- IAC0702 An understanding of the utilisation of hardware and software is demonstrated.

**(Weight 15%)**

**2.3 Provider Programme Accreditation Criteria**

*Physical Requirements:*

- Valid licensed 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.
- Learning platform/toolkit with relevant exercises and simulations.

*Human Resource Requirements:*

- Qualification of lecturer (SME):
  - NQF 5 industry recognised qualification with 1 years' 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)

**2.4 Exemptions**

- RPL based

### 3. 900100-000-00-KM-03, Fundamentals of 5G Technology, 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 fundamentals of 5G technology and the functioning thereof.

The learning will enable learners to demonstrate an understanding of:

- KM-03-KT01 : Fundamentals of 5G technology **10%**
- KM-03-KT02 : Main pillars and drivers of 5G development **15%**
- KM-03-KT03 : 5G New Radio (NR) spectrum **25%**
- KM-03-KT04 : 5G NR (new radio) technologies and specifications **30%**
- KM-03-KT05 : 5G data channels and identifiers **5%**
- KM-03-KT06 : Deployment **15%**

#### 3.2 Guidelines for Topics

##### 3.2.1. KM-03-KT01 : Fundamentals of 5G technology **10%**

**Topic elements to be covered include:**

- KT0101 Characteristics of 5G technology
- KT0102 Impact of 5G and its related emerging technologies
- KT0103 Possible applications

##### **Internal Assessment Criteria and Weight**

- IAC0101 Characteristics of 5G technology are evaluated in terms of speed, latency, IoT, bandwidth, digitalisation, availability, coverage, network energy usage, connected devices, etc.
- IAC0102 The impact of 5G and its related emerging technologies is identified and reasoned.
- IAC0103 Possible applications are identified.

**(Weight 10%)**

##### 3.2.2. KM-03-KT02 : Main pillars and drivers of 5G development **15%**

**Topic elements to be covered include:**

- KT0201 Key building blocks of 5G
- KT0202 5G requirements driving the development
- KT0203 Enhanced Mobile Broadband (eMBB)
- KT0204 Ultra-reliable and Low-latency Communication (URLLC)
- KT0205 Massive Machine-type Communications (mMTC)

##### **Internal Assessment Criteria and Weight**

- IAC0201 The respective main pillars are defined and discussed in terms of the respective characteristics and enabling role in 5G.
- IAC0202 Definitions, functions and features of the key building blocks of 5G are stated and explained.

**(Weight 15%)**

**3.2.3. KM-03-KT03 : 5G New Radio (NR) spectrum**

**25%**

**Topic elements to be covered include:**

- KT0301 Definition
- KT0302 NR spectrum
- KT0303 5G bands
- KT0304 Radio frequencies
- KT0305 Frequency ranges
- KT0306 Coverage
- KT0307 Function of the frequencies

**Internal Assessment Criteria and Weight**

- IAC0301 The 5G spectrum is defined as a range of radio frequencies in the sub-6 GHz range and the millimeter-wave (mmWave) frequency range that is 24.25 GHz and above.
- IAC0302 The 5G is described as radio frequencies that carry data from user equipment (UE) to cellular base stations to the data's endpoint.

**(Weight 25%)**

**3.2.4. KM-03-KT04 : 5G NR (new radio) technologies and specifications**

**30%**

**Topic elements to be covered include:**

- KT0401 Main features of 5G NR
- KT0402 Massive MIMO
- KT0403 mmWave (millimetre)
- KT0404 Edge computing
- KT0405 Small cells
- KT0406 Beamforming
- KT0407 Convergence of Wi-Fi technology
- KT0408 NOMA (non-orthogonal multiple access)
- KT0409 SDN/NFV
- KT0410 Channel coding
- KT0411 Operation in unlicensed spectrum
- KT0412 Dynamic spectrum sharing

**Internal Assessment Criteria and Weight**

- IAC0401 5G NR is defined.
- IAC0402 The specification requirements that drive 5G are identified.
- IAC0403 The main features and objective of mmWave are identified.
- IAC0404 The function of small cells for 5G is elaborated.
- IAC0405 Dynamic spectrum sharing and massive MIMO are defined, their respective objectives are described and advantages and disadvantages are compared.
- IAC0406 Beamforming and its applications are defined.



**(Weight 30%)**

**3.2.5. KM-03-KT05 : 5G data channels and identifiers 5%**

**Topic elements to be covered include:**

- KT0501 5G data channels
- KT0502 5G network identifiers

**Internal Assessment Criteria and Weight**

- IAC0501 5G data channels and identifiers are explained in terms of definitions, functions and features
- IAC0502 Key 5G data channels and identifier concepts and aspects are listed and described.

**(Weight 5%)**

**3.2.6. KM-03-KT06 : Deployment 15%**

**Topic elements to be covered include:**

- KT0601 Mobile operator networks
- KT0602 Private networks
- KT0603 Applications in industrial IoT, enterprise networking and critical communications
- KT0604 Electromagnetic interference
- KT0605 Spectrum
- KT0606 Unlicensed spectrum
- KT0607 5G devices

**Internal Assessment Criteria and Weight**

- IAC0601 Deployment options are defined and discussed in terms of advantages and disadvantages.

**(Weight 15%)**

**3.3 Provider Programme Accreditation Criteria**

*Physical Requirements:*

- Valid licensed 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.
- Learning platform/toolkit with relevant exercises and simulations.

*Human Resource Requirements:*

- Qualification of lecturer (SME):
  - NQF 5 industry recognised qualification with 1 years' 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**

- RPL based

## 4. 900100-000-00-KM-04, 5G Infrastructure, 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 5G infrastructure, architecture and technologies related to network slicing, design, deployment and maintenance.

The learning will enable learners to demonstrate an understanding of:

- KM-04-KT01 : 5G network infrastructure elements **25%**
- KM-04-KT02 : 5G network architecture **25%**
- KM-04-KT03 : 5G End-to-end architecture **15%**
- KM-04-KT04 : Network slicing and technical slice components **20%**
- KM-04-KT05 : Technologies for design, deployment and maintenance of 5G Networks **15%**

### 4.2 Guidelines for Topics

- 4.2.1. KM-04-KT01 : 5G network infrastructure elements **25%****

**Topic elements to be covered include:**

- KT0101 Three main layers
- KT0102 Core network, the backbone of network exchanges, gathering and dispatching data packages
- KT0103 Radio Access Network, made up of equipment that links the core network to user devices
- KT0104 Services and systems, overall architecture and service capabilities
- KT0105 Coordination of multiple hardware and software elements
- KT0106 Interoperability
- KT0107 Good network performance and economic efficiency in production
- KT0108 Standardized interfaces and specifications

**Internal Assessment Criteria and Weight**

- IAC0101 Three main layers of network infrastructure are identified and discussed.
- IAC0102 The functions and characteristics of the respective elements of the 5G network are elaborated.
- IAC0103 The interconnectivity of the infrastructure elements is identified and described.

**(Weight 25%)**

- 4.2.2. KM-04-KT02 : 5G network architecture **25%****

**Topic elements to be covered include:**

- KT0201 5G key design principles
- KT0202 Key technologies and enablers for 5G
- KT0203 5G network slicing
- KT0204 Edge computing, CUPS and Multi Connectivity
- KT0205 Network architecture from 4G to 5G
- KT0206 5G core (5GC) service-based architecture (SBA)
- KT0207 5G detailed Network Architecture
- KT0208 5G interfaces

- KT0209 Antennae design problems

**Internal Assessment Criteria and Weight**

- IAC0201 Key 5G network architecture principles, technologies and enablers are listed and described.
- IAC0202 Key 5G network architecture concepts and aspects are listed and described.

**(Weight 25%)**

**4.2.3. KM-04-KT03 : 5G End-to-end architecture 15%**

**Topic elements to be covered include:**

- KT0301 5G radio architecture
- KT0302 Standalone vs non-standalone architectures
- KT0303 5G deployment options
- KT0304 NG core architecture
- KT0305 Network slicing

**Internal Assessment Criteria and Weight**

- IAC0301 Definitions, functions and characteristics of 5G End-to-end architecture are stated and explained.

**(Weight 15%)**

**4.2.4. KM-04-KT04 : Network slicing and technical slice components 20%**

**Topic elements to be covered include:**

- KT0401 What is Network Slicing ( 3GPP, NGMN, 5G PPP)
- KT0402 Benefits of Network slicing
- KT0403 Technical components of Slice ( NSSAI, SST, SD, NSI ...)
- KT0404 Different Types of NSSAI
- KT0405 Slice selection procedure & Call Flow
- KT0406 Network slicing allows you to have multiple logical “slices” of functionality optimized for specific use-cases, all operating on a single physical core within the 5G network infrastructure
- KT0407 Slicing and optimisation: e.g. A 5G network operator may offer one slice that is optimized for high bandwidth applications, another slice that's more optimized for low latency, and a third that's optimized for a massive number of IoT devices
- KT0408 Devices using 5G – increased capabilities will be more costly

**Internal Assessment Criteria and Weight**

- IAC0401 Network slicing and technical slice components are identified and described in terms of functions and characteristics.
- IAC0402 Network slicing and technical slice components are discussed in terms of benefits.

**(Weight 20%)**

**4.2.5. KM-04-KT05 : Technologies for design, deployment and maintenance of 5G Networks 15%**

**Topic elements to be covered include:**

- KT0501 Technologies for design, deployment and maintenance of 5G Networks

**Internal Assessment Criteria and Weight**

- IAC0501 Technologies for design, deployment and maintenance of 5G Networks are identified and their functions are stated.

**(Weight 15%)**

### **4.3 Provider Programme Accreditation Criteria**

*Physical Requirements:*

- Valid licensed 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.
- Learning platform/toolkit with relevant exercises and simulations.

*Human Resource Requirements:*

- Qualification of lecturer (SME):
  - NQF 5 industry recognised qualification with 1 years' 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)

### **4.4 Exemptions**

- RPL based

## 5. 900100-000-00-KM-05, Performances, Services and Applications, 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 the 5G cellular network performance, services and applications.

The learning will enable learners to demonstrate an understanding of:

- KM-05-KT01 : 5G target services and performance goals **20%**
- KM-05-KT02 : Virtualisation and automation technologies and user equipment **20%**
- KM-05-KT03 : 5G and digital devices and applications **30%**
- KM-05-KT04 : 5G architecture, the Cloud and the Edge **30%**

### 5.2 Guidelines for Topics

#### 5.2.1. KM-05-KT01 : 5G target services and performance goals **20%**

*Topic elements to be covered include:*

- KT0101 Services offered by 5G
- KT0102 Performance goals
- KT0103 Comparison between 5G and 4G performance

**Internal Assessment Criteria and Weight**

- IAC0101 5G target services and performance goals are explained.
- IAC0102 A comparison between 5G and 4G is conducted in terms of performance.

**(Weight 20%)**

#### 5.2.2. KM-05-KT02 : Virtualisation and automation technologies and user equipment **20%**

*Topic elements to be covered include:*

- KT0201 Characteristics: scalability, flexibility, agility, reduced cost
- KT0202 Virtualisation technologies and UE
- KT0203 Automation technologies and UE

**Internal Assessment Criteria and Weight**

- IAC0201 Definitions, functions and characteristics of virtualisation and automation technologies are stated and explained.

**(Weight 20%)**

#### 5.2.3. KM-05-KT03 : 5G and digital devices and applications **30%**

*Topic elements to be covered include:*

- KT0301 Variety of services
- KT0302 Edge computing
- KT0303 Augmented Reality/Virtual Reality (AR/VR)
- KT0304 Impact of 5G on AR/VR
- KT0305 Industries using AR/VR

**Internal Assessment Criteria and Weight**

- IAC0301 The impact of 5G on AR/VR is motivated.
- IAC0302 The impact of the combination of factors such as 5G access networks, edge computing, high-performance distributed 5G core capabilities and new devices is argued.

**(Weight 30%)**

**5.2.4. KM-05-KT04 : 5G architecture, the Cloud and the Edge 30%**  
**Topic elements to be covered include:**

- KT0401 Edge computing
- KT0402 Cloud computing
- KT0403 Artificial intelligence
- KT0404 Machine Learning
- KT0405 Internet of things (IoT)

**Internal Assessment Criteria and Weight**

- IAC0401 The benefits of 5G in terms of edge computing, cloud computing, AI, ML and IoT are reasoned.

**(Weight 30%)**

**5.3 Provider Programme Accreditation Criteria**

*Physical Requirements:*

- Valid licensed 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.
- Learning platform/toolkit with relevant exercises and simulations.

*Human Resource Requirements:*

- Qualification of lecturer (SME):
  - NQF 5 industry recognised qualification with 1 years' 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)

## 5.4 Exemptions

- RPL based



### **SECTION 3B: APPLICATION MODULE SPECIFICATIONS**

The following Application Modules are compulsory

- 900100-000-00-PM-01, Set Up a Workstation and a User Account in a NOC, NQF Level 4, Credits 4
- 900100-000-00-PM-02, Monitor 5G Cellular Network Performance, NQF Level 4, Credits 18
- 900100-000-00-PM-03, Troubleshoot and Solve 5G Network Related Problems, NQF Level 4, Credits 4

## 1. 900100-000-00-PM-01, Set Up a Workstation and User Account in a NOC, NQF Level 4, Credits 4

### 1.1 Purpose of the Application Module

The focus of the learning in this module is on providing the learner with an opportunity to utilise physical tools, dashboard and specific interfaces or functionalities of the vendor specific toolkit/platform to set up a workstation, user accounts and implement security controls.

The learner will be required to:

- AM-01-PS01 : Utilise physical tools, dashboard and specific interfaces or functionalities of the vendor specific toolkit/platform
- AM-01-PS02 : Set up and configure a workstation
- AM-01-PS03 : Set up user accounts
- AM-01-PS04 : Install and configure 4G/5G software/toolkits
- AM-01-PS05 : Upgrade systems with new releases and models
- AM-01-PS06 : Implement security controls through access controls, backups and working on firewalls

### 1.2 Guidelines for Practical Skills

**AM-01-PS01 : Utilise physical tools, dashboard and specific interfaces or functionalities of the vendor specific toolkit/platform**

#### ***Scope of Application Topic:***

Given access to a learning platform that can simulate the below exercises (computers with basic setup and do the configuration without risk of the real setup), the learner must be able to:

- PA0101 Interact with the system: mouse keyboard, lights, sirens, alerts
- PA0102 Become proficient in specific interfaces or functionalities, namely
  - access
  - call logging
  - ticket management
  - network monitoring
- PA0103 Navigate between the different functions of the toolkit

#### ***Applied Knowledge***

- AK0101 NOC procedures
- AK0102 NOC layout

#### ***Internal Assessment Criteria***

- IAC0101 Proficiency in the use of physical tools, dashboard and specific interfaces or functionalities of the vendor specific toolkit/platform is demonstrated.

**AM-01-PS02 : Set up and configure a workstation**

#### ***Scope of Application Topic:***

Given access to a learning platform that can simulate the below exercises (computers with basic setup and do the configuration without risk of the real setup), the learner must be able to:

- PA0201 Create virtual machines
- PA0202 Enable API key authentication
- PA0203 Create a restricted read-only user
- PA0204 Allow for shared access to the dashboard by a restricted read-only user

**Applied Knowledge**

- AK0201 Functionalities of software toolkit/platform

**Internal Assessment Criteria**

- IAC0201 The workstation is operable and performs to desired requirements.

**AM-01-PS03 : Set up user accounts**

**Scope of Application Topic:**

Given access to a learning platform that can simulate the below exercises (computers with basic setup and do the configuration without risk of the real setup), the learner must be able to:

- PA0301 Add users onto the network by creating user accounts according to permissions and authorisations

**Applied Knowledge**

- AK0301 Toolkit functionality to set up user accounts

**Internal Assessment Criteria**

- IAC0301 Users are added to the network and have access according to permissions and authorisations.

**AM-01-PS04 : Install and configure 4G/5G software/toolkits**

**Scope of Application Topic:**

Given access to a learning platform that can simulate the below exercises, the learner must be able to:

- PA0401 Set up a virtual environment
- PA0402 Install 4G/5G vendor specific toolkits
- PA0403 Configure 4G/5G vendor specific toolkits
- PA0404 Familiarise self with the functionalities of vendor specific toolkit
- PA0405 Utilise functionalities of 4G/5G vendor specific toolkits and navigate between functionalities.

**Applied Knowledge**

- AK0401 Toolkit/platform installation functionalities

**Internal Assessment Criteria**

- IAC0401 4G/5G vendor specific software/toolkits are installed and configured, they are operable, all errors are resolved and they are performing to desired standards.
- IAC0402 Vendor specific toolkit functionalities are used.

**AM-01-PS05 : Upgrade systems with new releases and models**

**Scope of Application Topic:**

Given access to a learning platform that can simulate the below exercises, the learner must be able to:

- PA0501 Set up a virtual environment
- PA0502 Upgrade virtual machines and all the virtual setups
- PA0503 Install new versions or patches and do patch management

**Applied Knowledge**

- AK0501 Virtual environment functionalities

**Internal Assessment Criteria**

- IAC0501 The upgraded system is operable and new releases and models perform to desired requirements.

**AM-01-PS06 : Implement security controls through access controls, backups and working on firewalls**

**Scope of Application Topic:**

Given access to a learning platform that can simulate the below exercises, case studies and prior experience, the learner must be able to:

- PA0601 Set up access controls according to specific scripts that manage access onto the network
- PA0602 Create backups depending on the environment - could be tapes, external storage and cloud
- PA0603 Monitor firewalls to ensure upkeep and no downtime and ensure security protocols are operating
- PA0604 Make sure the network protocols are followed

**Applied Knowledge**

- AK0601 Functionalities related to access controls, backups and working on firewalls

**Internal Assessment Criteria**

- IAC0601 Access controls, backups and firewalls are functional and performing to required standards

### 1.3 Provider Programme Accreditation Criteria

#### *Physical Requirements:*

- Valid licensed 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.
- Learning platform/toolkit with relevant exercises and simulations.

#### *Human Resource Requirements:*

- Qualification of lecturer (SME):
  - NQF 5 industry recognised qualification with 1 years' 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)

### 1.4 Exemptions

- RPL based

## 2. 900100-000-00-PM-02, Monitor 5G Cellular Network Performance, NQF Level 4, Credits 18

### 2.1 Purpose of the Application Module

The focus of the learning in this module is on providing the learner with an opportunity to apply recognised standards and monitor 5G cellular network performance

The learner will be required to:

- AM-02-PS01 : Use a dashboard and interpret technical information in order to monitor and activate tickets
- AM-02-PS02 : Monitor call and SMS service flow in 5G mobile cellular networks
- AM-02-PS03 : Monitor data service flow in 5G mobile cellular networks
- AM-02-PS04 : Monitor performance and maintain network systems according to requirements

### 2.2 Guidelines for Practical Skills

- 2.2.1. AM-02-PS01 : Use a dashboard and interpret technical information in order to monitor and activate tickets**

#### **Scope of Application Topic:**

Given access to a learning platform that can simulate the below exercises, the learner must be able to:

- PA0101 Log onto the system using the vendor specific tool/platform
- PA0102 Navigate between various functionalities and views to monitor various aspects of network performance
- PA0103 Read technical information from the dashboard: gauges, graphs, alerts
- PA0104 Use metrics to measure performance
- PA0105 Apply units of measurement (e.g., latency is measured using TCP packets) as relevant to network performance
- PA0106 Track tasks using the vendor specific tool and dashboard
- PA0107 Read graphs and charts and understand lights and alerts

#### **Applied Knowledge**

- AK0101 Meaning of dashboard controls and technical information displayed

#### **Internal Assessment Criteria**

- IAC0101 Proficiency is demonstrated in using the vendor specific tool/platform.
- IAC0102 Proficiency is demonstrated in navigating between various functionalities and views.
- IAC0103 Proficiency is demonstrated in reading technical information from the dashboard.
- IAC0104 Proficiency is demonstrated in using the tool and dashboard to monitor aspects of network performance.

- 2.2.2 AM-02-PS02 : Monitor call and SMS service flow in 5G mobile cellular networks**

#### **Scope of Application Topic:**

Given access to a learning platform that can simulate the below exercises, the learner must be able to:

- PA0201 Use a dashboard (tool) that manages all logs
- PA0202 Monitor the actual physical calls coming in and monitor for call drops

- PA0203 Share information with billing department to correct the billing if applicable
- PA0204 Issue a ticket in case of call and SMS service flow problems (if necessary)
- PA0205 Monitor SMS tickets to ensure the task is executed and close tickets which were completed
- PA0206 Pass on issued tickets to in-field technicians and monitor completions
- PA0207 Log internal facing problem for technicians at the NOC to resolve remotely
- PA0208 Log external facing problem for technicians to be deployed to a site

**Applied Knowledge**

- AK0201 Functionalities for monitoring call and SMS flow through the network

**Internal Assessment Criteria**

- IAC0201 Call and SMS service flow is monitored and any deviation from the norm is acted upon per SOP for the specific deviation.
- IAC0202 Tickets are issued as and when necessary to maintain the call and service flow at acceptable levels.

**2.2.3. AM-02-PS03 : Monitor data service flow in 5G mobile cellular networks**

**Scope of Application Topic:**

Given access to a learning platform that can simulate the below exercises, the learner must be able to:

- PA0301 Perform light management (green, amber, red) indicating severity of the operations.
- PA0302 Issue tickets in response to change in lights and different levels of responses and different levels of response teams
- PA0303 Use a dashboard (tool) that manages all logs and ensure uptime of the network
- PA0304 Monitor data service flow by using the toolkit
- PA0305 Log internal facing problem for technicians at the NOC to resolve remotely
- PA0306 Log external facing problem for technicians to be deployed to a site

**Applied Knowledge**

- AK0301 Functionalities and standards for monitoring data service flow

**Internal Assessment Criteria**

- IAC0301 Data service flow in a 5G mobile cellular network is monitored in terms of % performance.

**2.2.4. AM-02-PS04 : Monitor performance and maintain network systems according to requirements**

**Scope of Application Topic:**

Given access to a learning platform that can simulate the below exercises, the learner must be able to:

- PA0401 Respond to pre-set and predefined alerts, e.g. flash on the screen, and take action.
- PA0402 Monitor servers, switches and routers 24/7 to ensure that they operate at peak performance levels
- PA0403 Resolve calls within the pre-determined set time to avoid penalties
- PA0404 Monitor on-screen what the statuses of the tickets are and escalate problems with tickets
- PA0405 Apply SLA management to stay within the confines of the stipulated service (SLA) requirements
- PA0406 Issue or Escalate a ticket by pre-empting (green, amber, red) risk and action ticket to address risk remotely from the NOC, if possible
- PA0407 Develop reports on network performance, optimisation and health

#### ***Applied Knowledge***

- AK0401 Functionalities for monitoring performance and maintain network systems

#### ***Internal Assessment Criteria***

- IAC0401 Performance is monitored and network systems are maintained

### **2.3 Provider Programme Accreditation Criteria**

#### *Physical Requirements:*

- Valid licensed 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.
- Learning platform/toolkit with relevant exercises and simulations.

#### *Human Resource Requirements:*

- Qualification of lecturer (SME):
  - NQF 5 industry recognised qualification with 1 years' 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)

### **2.4 Exemptions**

- RPL based



### 3. 900100-000-00-PM-03, Troubleshoot and Solve 5G Network Related Problems, NQF Level 4, Credits 4

#### 3.1 Purpose of the Application Module:

The focus of the learning in this module is on providing the learner with an opportunity to apply troubleshooting procedures to resolve network related problems

The learner will be required to:

- AM-03-PS01 : Use a diagnostic tool of the vendor specific toolkit/platform to troubleshoot and do fault-finding in terms of various types of network problems
- AM-03-PS02 : Remediate various types of network problems
- AM-03-PS03 : Reboot servers from the dashboard - some activities can be done remotely
- AM-03-PS04 : Maintain technical documentation, manuals and IT policies
- AM-03-PS05 : Produce and distribute daily reports if there are any changes to the system (e.g., what went down, what was wrong and how it was rectified).

#### 3.2 Guidelines for Practical Skills

- 3.2.1. AM-03-PS01 : Use a diagnostic tool of the vendor specific toolkit/platform to troubleshoot and do fault-finding in terms of various types of network problems**

##### **Scope of Application Topic:**

Given access to a learning platform with a simulated problem (Range: networks, routers and switches, servers, applications, websites, firewalls, VPN tunnels, Wireless access points, LANs/WANs/MANs, power and facility systems), the learner must be able to:

- PA0101 Determine that there is a problem using information on the dashboard
- PA0102 Get more details about the identified problem using a fault-finding tool
- PA0103 Get more details about the alert
- PA0104 Establish the root cause of the problem:
  - Trace faults
  - Find the fault location

##### **Applied Knowledge**

- AK0101 Functionalities of the diagnostic tools

##### **Internal Assessment Criteria**

- IAC0101 A diagnostic tool of the vendor specific toolkit/platform is used to troubleshoot and do fault-finding in terms of various types of network problems (e.g., networks, routers and switches, servers, applications, websites, firewalls, VPN tunnels, Wireless access points, LANs/WANs/MANs, power and facility systems)

- 3.2.2 AM-03-PS02 : Remediate various types of network problems**

##### **Scope of Application Topic:**

Given access to a learning platform with a simulated problem (Range: networks, routers and switches, servers, applications, websites, firewalls, VPN tunnels, Wireless access points, LANs/WANs/MANs, power and facility systems), the learner must be able to:

- PA0201 Resolve the issue using remote access tools to access the network remotely
- PA0202 Verify full system functionality

- PA0203 Document all information related to the fault and remediation actions taken (thus what went down, what was wrong and how it was rectified)

**Applied Knowledge**

- AK0201 Problem-solving procedures

**Internal Assessment Criteria**

- IAC0201 Various types of network problems (e.g., networks, routers and switches, servers, applications, websites, firewalls, VPN tunnels, Wireless access points, LANs/WANs/MANs, power and facility systems) are remediated.
- IAC0202 All information related to the fault as well as remediation actions taken (thus what went down, what was wrong and how it was rectified) are documented.

**3.2.3. AM-03-PS03 : Reboot servers from the dashboard – if applicable, some activities can be done remotely**

**Scope of Application Topic:**

Given access to a learning platform with a simulated problem relating to rebooting of servers, the learner must be able to:

- PA0301 From the dashboard and done remotely; reset the network interfaces
- PA0302 From the dashboard and done remotely; restart crashed applications:
- PA0303 Advise the end-user to do same at the end-user side
- PA0304 Institute remote system triage to quickly resolve issues by communicating with the end-user or the technician

**Applied Knowledge**

- AK0301 Rebooting procedures

**Internal Assessment Criteria**

- IAC0301 Servers are rebooted if they are not green when coming up.
- IAC0302 From the dashboard some activities can be done remotely. Indicators must be as expected.

**3.2.4. AM-03-PS04 : Maintain technical documentation, manuals and IT policies**

**Scope of Application Topic:**

Given access to a learning platform with a simulated problem, the learner must be able to:

- PA0401 Document any changes to the system
- PA0402 Submit documented changes for updating the procedure manuals

**Applied Knowledge**

- AK0401 Types of technical documentation and what it is used for

**Internal Assessment Criteria**

- IAC0401 Technical documentation, manuals and IT policies are maintained.

- 3.2.5. AM-03-PS05 : Produce and distribute daily reports if there are any changes to the system (e.g., what went down, what was wrong and how it was rectified).**

***Scope of Application Topic:***

Given access to a learning platform with a simulated problem, the learner must be able to:

- PA0501 Check daily logs (e.g., load-shedding and the impact of power outages on the network itself)
- PA0502 Produce and distribute daily reports if there are any changes on the system – what went down, what was wrong and how it was rectified
- PA0503 No specific format – configurations on the dashboard to distribute reports

***Applied Knowledge***

- AK0501 Reporting procedures and functionalities

***Internal Assessment Criteria***

- IAC0501 Daily reports are produced and distributed if there are any changes to the system (e.g., what went down, what was wrong and how it was rectified)

**3.3 Provider Programme Accreditation Criteria**

*Physical Requirements:*

- Valid licensed 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.
- Learning platform/toolkit with relevant exercises and simulations.

*Human Resource Requirements:*

- Qualification of lecturer (SME):
  - NQF 5 industry recognised qualification with 1 years' 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**

- RPL based