QUALIFICATION SPECIFICATION							SECTION A
QUALIFICATION DEVELOPER	Institute of Development Management						
TITLE	Bachelor of Science in Computer Network Engineering			**NCQF LEVEL**	7		
FIELD	Information and Communication Technology		**SUB-FIELD**	Computer Networking			
New qualification	✓	Review of existing qualification					
SUB-FRAMEWORK	General Education		TVET		Higher Education	✓	
QUALIFICATION TYPE	Certificate		Diploma		Bachelor	✓	
	Bachelor Honours		Master		Doctor		
MINIMUM CREDIT VALUE	484						

RATIONALE AND PURPOSE OF THE QUALIFICATION

Rationale

Information and communication technology (ICT) is one of the cross-cutting issues as reverberated in the Education for All (EFA), the Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDG's). Botswana is aligned and committed to the implementation of the National ICT Policy that will position Botswana for sustained growth in the digital age by serving as a key catalyst in achieving social, economic, political and cultural transformation within the country (ETSSP, 2015). This commitment is subsequent to policies such as the Revised National Policy on Education (RNPE) (1994) and the Information Communication and Technology (ICT) Policy (2004) that emphasized the need for integration and sustainability of ICT in both the education system at the national level. The Government of Botswana has long realized the critical role of Information and Communication Technology (ICT) in economic development. This was consolidated and articulated in the National Information Technology Policy of 2007, commonly referred to as *Maitlamo* which presents ICT as a key driver of social, economic, cultural and political transformation.

The Thuto Net strategy under the Ministry of Education and Skills Development aims to use ICT as an enabler to enhance the teaching and learning process through E-learning.

The Education and Training Sector Strategic Plan (ETSSP 2015-2020) which sets out to improve the performance of the education sector views ICT as a driver of all the key initiatives and hence sets out to utilize and integrate ICT in the education sector. Similarly, all other sectors are repositioning themselves to optimize the use of ICT for enhance their performance and contribute to the envisaged transformed Botswana characterized by sustainable economic growth.

Botswana Vision 2036 acknowledges Information and Communication Technology as a key contributor to economic growth by enabling private and public sector employment growth opportunities (Page 17).

Network skills have been identified as being in high demand by HRDC (2016) code **2523** and **2514** based on the labour market analysis conducted by the HRDC.

This qualification aims to develop learners with necessary computer networking knowledge, skills and practical experience to enable them to meet challenges, initiatives and market demand. The modules provided will equip learners with skills and knowledge in computer networking field.

This qualification will provide learners with computer networking knowledge, skills and competencies aligned to the industry need in emerging economies and thus resonate with the aspirations of self-reliance in the country, the region, and beyond.
An industrial survey conducted from different expects established the qualification was viable, needed and sustainable.
The purpose of the qualification is to provide learners with skills and competencies in designing and configuring computer networks as well as exploring the latest developments in communication technologies, such as the cloud, the Internet of Things and next-generation networks. Learners will graduate to become competent computer networking, practical skills and competencies which are in demand in the industry for managing and supporting daily business operations.

The purpose of the qualification is to produce graduates that will demonstrate:

1. Knowledge of computer networking concepts, terminologies in network design.
2. Understanding of computer network requirements and provide solutions to business needs.
3. Produce graduates that will demonstrate the ability to analyses business and corporate strategies in the context of computer networking.
4. Skills in developing object-oriented programmes to address loosely defined problems.
5. Knowledge and understanding of computer network security
6. Understanding of the concepts associated with database systems and be able to develop a database system.
7. Skills in web coding, and an understanding of website design and testing.

ENTRY REQUIREMENTS (including access and inclusion)

1. Certificate IV, NCQF level 4 in General Education.
2. There will be admission through CAT and RPL means according to National RPL and CAT Policies.

QUALIFICATION SPECIFICATION	**SECTION B**
GRADUATE PROFILE (LEARNING OUTCOMES) At the end of this qualification, the learner will be able to:	**ASSESSMENT CRITERIA**
LO 1. Demonstrate knowledge of computer networking concepts, terminologies in network design	1.1 Apply computer network concepts using simulators 1.2 Demonstrate an understanding of routing and switching in computer networks

	1.3 Outline network principles concepts, topologies and architectures 1.4 Apply network concepts in real life environment 1.5 Create LAN and WAN simulation and logical design 1.6 Design logical and physical network 1.5 Create the hardware components for a wireless network 1.6 Analyze the data transfer in a computer network. 1.7 Analyze the requirement of computer networks data through Network Interface cards and hard drive access speeds
LO2. Analyse computer network requirements and formulate solutions to business needs	reate network simulation using network simulators nalyze computer network scenario requirements reate Computer Networking business process for the rganization. 2.3 Analyze key characteristics of computer network infrastructures. 2.4 Describe business modelling from computer network perspective. 2.5 Illustrate different internet communication architectures
LO 3. Analyze business and corporate strategies in the context of computer networking.	3.1 Analyze different business network strategies 3.2 Analyze the influence of changing strategies on each computer network strategy. 3.3 Describe the role and significance of computer network in modern business organizations 3.4 Identify external and internal factors that impact on the performance of the computer networking 3.5 Demonstrate awareness in IT funding strategies.
LO 4. Demonstrate wide and general knowledge and understanding of the major key fields within the computer essentials and online essentials	4.1 Analyze a set of classes and their interrelationships to address the problem 4.2 Apply effective use of encapsulation, inheritance and polymorphism 4.3 Select and reuse pre-existing objects and templates specializing as required 4.4 Structure the design so that objects communicate efficiently 4.5 Specify the properties and behavior of classes to allow efficient implementation, selecting appropriate data types, data and file structures and algorithms 4.6 Apply the design using well-established Notations 4.7 Apply appropriate data validation and error handling techniques
LO 5. Demonstrate knowledge and understanding of computer network security	5.1 Demonstrate a critical understanding of the concepts and principles of information security

	5.2 Illustrate data encryption and encryption algorithms. 5.3 Demonstrate a understanding of computer security threads 5.4 Create encryption using computer security software 5.5 Configure firewalls, wireless security and virtual private network security
LO 6. Understand the concepts associated with database systems and be able to develop a database system	6.1 Design and implement databases to a specification. 6.2 Model the database concept to enterprises 6.3 Create databases 6.4 Demonstrate understanding of the core theories and principles associated with the relational data model 6.5 Enhance database concepts through DBMS 6.6 Manipulate database using database languages 6.7 Create database to solve a problem using different DBMS
L0 7 Design and develop web-based applications, and test them using appropriate test strategies.	7.1 Demonstrate use of various tools for Web Application Development 7.2 Create data driven web application to meet design specifications 7.3 Be able to create and deploy web services 7.4 Design a website to address loosely defined requirements 7.5 Develop test strategies and apply these to a website 7.6 Create web page based on given systems requirements
LO 8. Demonstrate knowledge and application skills in Microsoft application	8.1 Create documents and save them in different file formats. 8.2 Choose built-in options, such as the Help function, to enhance productivity. 8.3 Create mathematical and logical formulas using standard spreadsheet functions 8.4 Create and edit small-sized word and excel processing documents that will be ready to share and distribute. 8.5 Apply different formats to documents to enhance them before distribution; recognize good practice in choosing the appropriate formatting options. 8.6 Create tables, images, and drawn objects into documents. 8.7 Prepare documents for mail merge operations. 8.8 Adjust document page settings.

QUALIFICATION STRUCTURE

SECTION C

	Title	**Level**	**Credits**
FUNDAMENTAL COMPONENT	Communications and Academic Writing Skills	5	**12**
	ICDL Computer Essentials	5	**5**

Subjects / Units / Modules /Courses	ICDL Word Processing	5	**5**
	ICDL Spreadsheets	5	**5**
	ICDL Online Essentials	5	**5**
	Professional Communication	6	**12**
	Introduction to Entrepreneurship and Innovation	7	**10**
	Fundamentals of Venture Creation	7	**10**
CORE COMPONENT Subjects / Units / Modules /Courses	Introduction to Information Systems	6	**10**
	Computational Mathematics and Algorithms	6	**10**
	Website Design (WEBDN)	6	**10**
	Principles of Computer Networks	6	**10**
	Computer Organization and Architecture	6	**10**
	Database Theory and Practice	6	**10**
	Network Administration I – Routing and Switching	6	**10**
	Systems Analysis and Design	6	**10**
	IT Project Management Fundamentals	6	**10**
	Dynamic Web Design	6	**10**
	Network Administration Infrastructure	6	**10**
	Linux Administration	7	**15**
	Network Administration II - Routing and Switching	7	**15**
	Network Security I	7	**15**
	IT Project (REPROJ202)	7	**15**
	Server Management and Administration Infrastructure	7	**15**
	Advanced Database Management Systems	**7**	**15**
	Professional Issues In IT	7	**15**
	Electronic Business	7	**15**
	Network Administration III	7	**15**
	Agile Development	7	**15**
	Business Modelling	7	**15**
	Project Management	7	**15**
	Network Security II	7	**20**
	Managing Information Systems Projects	7	**15**
	Research Project	7	**20**
	Internship	7	**30**
ELECTIVE COMPONENT Subjects / Units / Modules /Courses	Mobile Computing	7	**15**
	Cloud Computing	**7**	**15**
Rules of combinations, Credit distribution (where applicable):			

Level & Credit	Fundamental	Core	Elective	
5	32	0	0	
6	12	110	0	
7	20	295	15	
8	0	0		
Total	64	405	15	
Grand Total			484	

- This qualification will have at least 484 credits and take at least four years to complete including a full semester internship under the normal fulltime mode of study.
- The credit combination for this qualification is from 64 fundamental components, 405 core components and the remaining 15 is from elective components, where candidates will choose any one.
- The 30 credits internship module, called the Internship module, may typically be done after the student has passed at least 454 credits worth of modules.
- The qualifications structure is premised on these rules of combination.

ASSESSMENT AND MODERATION ARRANGEMENTS

Summative assessment
Summative assessment based on learning out comes leading to the award of the qualification will be done contributing 60% of the overall mark.

Formative assessment- informs teaching and learning
Learners are continuously assessed to evaluates learner learning, knowledge, proficiency which constitutes 40% of the overall module mark

Moderation:
There will be provision for moderation (internal and external) arrangements for the qualification through

BQA accredited and registered moderators.

Professional registration and accreditation
Assessors and moderators must have valid registration and accreditation with all or some of the relevant bodies such as:

- Botswana Qualifications Authority (BQA)
- Fortinet Network Security Expert
- Computer Information System Company- CISCO

RECOGNITION OF PRIOR LEARNING (if applicable)

Candidates may submit evidence of prior learning and current competence and/or undergo appropriate forms of RPL assessment for the award of credits towards the qualification in accordance with applicable RPL policies and relevant national-level policy and legislative framework. Implementation of RPL shall

also be consistent with requirements, if any, prescribed for the field or sub-field of study by relevant national, regional and international professional bodies.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Horizontal articulation(related qualifications of similar level that graduates may consider)
Bachelor of Science Degree in Software Engineering, at NCQF Level 7.
Bachelor of Science Degree in Computer Networks, at NCQF Level 7.
Bachelor of Science Degree in Mobile Applications, at NCQF Level 7

Vertical Articulation- Pathways which the holders may progress to
Bachelor of Science (Hons) in Computer Networking, at NCQF Level 8.
Bachelor of Science (Hons) in Network Security, at NCQF Level 8
Master of Science in Information Technology Management, at NCQF 9
Master of Science in Computer Security, at NCQF 9

Employment Pathways

System Administrator
Network Administrator
IT Entrepreneur
IT User Support
Systems Analyst
IT Consultant
Software Developer
Database Administrator
In the face of the declining job market, some graduates of the programme may consider self-employment as software developers, systems development and network support.

QUALIFICATION AWARD AND CERTIFICATION

To be awarded this qualification, a candidate must complete 64 Credits of the Fundamental Component, 405 Credits of the Core component and 15 Credits of the Elective component. Those who meet that requirement will be issued a certificate

To be awarded the **Bachelor of Science Degree in Computer Network Engineering** the student must achieve a minimum of 50% pass in all the modules registered and required for the qualification.

REGIONAL AND INTERNATIONAL COMPARABILITY

NB: Also see attached Comparability Matrix

Regionally

1. **The Independent Institute of Education Varsity College**
   Bachelor of Computer and Information Sciences in Networking Engineering (SAQA ID 97838)
   NQF Level : 7
   Credit Value :370

   Similarities

The Independent Institute of Education Varsity College Bachelor of Computer and Information Sciences in Networking Engineering consists of the following modules similar to these qualification
Mathematical Principles for Computer Science
Network Engineering
Principles of Security
Network Administration
Network Engineering
Wireless and Mobile Communication
Introduction to Research
IT Project Management

Differences
Work Integrated Learning
Enterprise Architecture
Emerging Network Technologies
Enterprise Resource Planning

Education and Employment Pathways
Network Engineering
Network Administration
Database Administration
Network Support
Network Architecture and Design
Enterprise Architecture
Enterprise Management

2. University of Pretoria – Bachelor of Computer Science (SAQA)
NCQF Level: 7
Credit Value: 480
Similarities:
The qualification offered by University of Pretoria consist of modules offered by this qualification which are Databases Theory and Practice, Computer Networks, Computer/Information Security, Entrepreneurship, Computer Mathematics and Communications and Academic Writing similar to this qualification.

Differences:
This qualification shares many common modules with the benchmarked qualifications. However, this qualification has additional modules like, Dynamic processing, statistics, E-Business, Concurrent Systems Server Management, Professional issues and Ethics and ICDL which are not included under Botswana Open University qualification.

Database Management Specialist
Systems developer
Application Developer
Web Developer
Software Engineer & Analyst
Software Business Entrepreneurs
Research & Development (R&D) Engineer & Manager

IT Sales & Marketing professional

3. The British University in Egypt
Degree in Computer Networking- Egyptian Supreme Council of Universities (SCU)
Credits:360
Level: 7
Learning outcomes:

- Knowledge and understanding of Essential facts, concepts, principles, basic sciences and theories related to computing and information applications.
- Analyze computing problems and provide solutions related to the design, construction and evaluation of computing systems.
- Explain the concepts, principles, theories, architecture, practices and tools behind computing, computers, computer networks and information as an academic discipline.
- Using state-of-the-art network devices in our Cisco laboratory, you'll design and configure your own networks as well as explore the latest developments in communication technologies.
- Gain valuable work experience on your placement if you choose to take one.
- Career opportunities are broad and can include roles such as network designer/engineer, network architect, IT manager or information systems manager.

Similarities:

Entrepreneurship and Innovation
Computer Networking Fundamentals
Computer Systems Security
Database Theory and Practice
Computer Organisation and Architecture
IT Individual Project
Software Systems Modelling
Advanced Networks
Systems Analysis and Design
CISCO Networking
Web Design
Network Configuration Management
Wireless Networks

Differences:

Humanities
Discrete Mathematics
Server Management Administration
Business Continuity Management
Physics – Electricity and Magnetism
Electronics and Digital Circuits
Scientific Thinking

Internationally

4. Universal College of Learning- New Zealand– Bachelor of Information and Communications Technology
Credits:360
Level: 7
Learning outcomes:

- Demonstrate knowledge in key networking protocols principles and their hierarchical relationship in the context of a conceptual model, such as the OSI and TCP/IP framework
- Build multiple host and network architectures, given business requirements and constraints;
- Configure operating systems, network specific services, routing, switching, and remote access solutions
- Understand the components of a computer and their role and function
- Manage multiple operating systems, systems software, network services, and security, and
- Demonstrate analytical skills in identifying and troubleshooting networking, security, and performance

Similarities
Network Fundamentals
Database Fundamentals
IT Project Management
Information Systems Fundamentals
Database architecture
Industry Project
Networks (CISCO RSE)
Database administration
Network security
Project management
Systems analysis
Programming

Differences
Enterprise Data Management
Data Analytics and Intelligence
Mobile application development
Corporate training
Game development
Introduction to Finance
Digital Multimedia

Education and Employment Pathways
Business & Systems Analysis
Data Management & Analytics
Network Engineering
Project Management
Security
Software Engineering
Systems Administration
Web & Mobile Development

Summary of Similarities and Differences Observed

The **Bachelor of Science in Computer Network Engineering** has a high level of similarity in structure and design with the qualifications referred to above in some of the leading universities of South Africa, Egypt and New Zealand. The qualifications were also comparable in terms of the target market; they were all geared towards upskilling Computer Network Engineers. In terms of assessments, there were slight variations in terms of the weightings for continuous assessment against final assessments, but all had components of assignments, projects, and final assessments. The duration of study is different ranging between THREE (3) - FOUR (4) years of study, and subsequently the credits are different as well as the entry requirements in the different countries vary. What sets the qualification apart is that it has a wider scope of modules heavily focused on Computer Network Engineering based on the skills needed by the market. The credit weight also set it apart as it have more credit value compared to others

Comparability and articulation of the proposed qualification with the ones examined

The course modules are similar even though they differ in names but the content is similar. The qualifications have targeted same educational pathways for aspiring graduates who want to be computer network engineers. The graduates profiles also articulate the similar outcomes and qualification objectives
The NQCF is at the same level
Differences
Assessments strategies and weightage of different assessment components eg Continuous Assessment, Projects/Assignment and Exams
Credit value is at 484

REVIEW PERIOD

Every 5 years. However, the IT landscape is forever changing and review of the qualification will provide a window for constant refining and updating where applicable, arising from legislative changes or stakeholder feedback

Other information – please add any supplementary information to help the application for this qualification for NCQF Registration.

- Summary of Credit Distribution
- Validation Matrix of the Exit Learning Outcomes against the level descriptors
- Stakeholder Engagement Feedback Report
- Checklist of Completeness

For Official Use Only:

CODE (ID)			
REGISTRATION STATUS	**BQA DECISION NO.**	**REGISTRATION START DATE**	**REGISTRATION END DATE**
LAST DATE FOR ENROLMENT		**LAST DATE FOR ACHIEVEMENT**	