SECTION A:	***QUALIFICATION DETAILS***
QUALIFICATION DEVELOPER (S)	Botswana Accountancy College

TITLE	Bachelor of Science in Network Systems Engineering	***NCQF LEVEL***	*7*

FIELD	Information and Communication Technology	***SUB-FIELD***	Network Systems Engineering	***CREDIT VALUE***	*480*

New Qualification	✓	*Review of Existing Qualification*	

SUB-FRAMEWORK	*General Education*		*TVET*		*Higher Education*	✓

QUALIFICATION TYPE	*Certificate*	*I*		*II*		*III*		*IV*		*V*		*Diploma*		*Bachelor*	✓

	Bachelor Honours		*Post Graduate Certificate*		*Post Graduate Diploma*	
	Masters		*Doctorate/ PhD*			

RATIONALE AND PURPOSE OF THE QUALIFICATION

Rationale:

Computer Networking is at the heart of every modern enterprise that thrives through digital communication and connectivity through the internet, wireless and wired networks [9]. This network interconnectivity enables seamless information sharing and global communication forming a competitive edge. Computer networks are an enabling nucleus in modern business and socio-economic fabrics enabling communication to occur at operational, tactical, and strategic levels seamlessly [1] *Association for Computing Machinery (ACM) & IEEE Computer Society, "Curriculum Guidelines for Undergraduate Degree Programs in Computer Engineering", A Report in the Computing Curricula Series Joint Task Group on Computer Engineering Curricula, October 2015.* The socio-economic fabric is glued together in communication by networks provided by various network service providers. The advent of computer networking also brought new aspects of securing the newly discovered resource of modern enterprises: data and information. Inasmuch as computer networks have brought communication through connectivity, there is need to fathom challenges brought up by globalization while enjoying the benefits of the information age [2][3] *Botswana Qualifications Authority, National Credit and Qualifications Framework (NCQF) Regulations-2016, published on 2nd December 2016.* In recent surveys of the local business sector, there have

been growing focus on ICT as part of the business value additions. [1] *Association for Computing Machinery (ACM) & IEEE Computer Society, "Curriculum Guidelines for Undergraduate Degree Programs in Computer Engineering", A Report in the Computing Curricula Series Joint Task Group on Computer Engineering Curricula, October 2015.* [2] *Association for Computing Machinery (ACM) & IEEE Computer Society, "A Report in the Curriculum Guidelines for Undergraduate Degree Programs in Computer Science", December 2013* [4] *Botswana Accountancy College: Needs Assessment Report 2019* [5] Consequently, ICT is being given more attention at strategy and planning level. However, the sector has expressed concerns about the level and type of skills availability in the local market to drive effective ICT developments in business [4] *Botswana Accountancy College: Needs Assessment Report 2019*. In the human resource development needs on information technology and entrepreneurship [10], ICT skills shortage exist in areas of security of business system, business system analysis, business application integration, and application design [5].

A qualification of this nature is necessary because it establishes a security and communication status quo in enterprises by use of hardware, software, and protocols established in the OSI model. The qualification tapes into future skills that include IT Services, Digital Transformation Specialists, New Technology Specialists, Organizational Development Specialists. [5][6]

In this qualification students will explore how to manage large installations in Windows and LINUX/UNIX. Students should benefit from hands-on networking design, simulation and implementation. Furthermore, it should provide an insight into the roles of system administrators, network engineers, IT infrastructure management and ICT support Technician as these are some of the many possible roles for computing graduates after the end of their studies.

The qualification is also aimed introducing theories behind networking and network systems and advanced understanding of routing and switching concepts. Students will develop practical skills in designing and building routed networks of the kind typically found in industry. This qualification also offers the opportunity to undertake exams for CISCO accreditation for various CCNA pathways such as Routing and Switching, Data Center Networking, Voice, Collaboration, Wireless and CCNA Security, which are all well-recognized and sought for industry accreditations.

PURPOSE:

The purpose of the qualification is to produce graduates who have specialised knowledge, advanced technical skills, and competencies to:

- Demonstrate and apply themselves in finding solutions to problems within the networking system discipline.
- Stimulate problem solving and entrepreneurship capabilities, network systems engineering, and ICT sector management and practical exposure.
- Apply analytical skills and decision-making skills in the formulation of business communication and security engineering societal solutions.
- Evaluate networking engineering systems and run various operations in the networking field as professional and with high level of professionalism.
- Analyse the factors that influence the operations of networking systems engineering within diverse business environments and business situations.
- Apply critical thinking and research skills in devising solutions to familiar and unfamiliar problems in a dynamic ICT sector and networking system engineering.

ENTRY REQUIREMENTS (including access and inclusion)

The minimum entry requirement is:

- Certificate IV, NCQF level 4 (General Education or TVET) or equivalent.
- Access through Recognition of Prior Learning (RPL) and Credit Accumulation and Transfer (CAT) will be provided through ETP policies in line with National RPL and CAT Policies.

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SECTION B	***QUALIFICATION SPECIFICATION***
GRADUATE PROFILE (LEARNING OUTCOMES)	***ASSESSMENT CRITERIA***
LO 1: Develop and demonstrate specialized Network Engineering knowledge and technical skills in using security engineering algorithms, tools, and methodologies to secure enterprises.	1.1. Implement networked environments to realize competitive edge of any business. 1.2. Build wired, wireless, and distributed network systems. 1.3. Assess critically security challenges associated with digital data/information in networked environments and diffuse them. 1.4. Integrate the business value of network technologies with business. 1.5. Recommend network solutions that are backed up by facts and data.
LO 2: Apply a range of advanced technical processes and skills in the formulation of business communication and security engineering societal solutions.	2.1Appraise critically the issues involved in the networking of fixed, mobile, satellite and land-based communications systems for voice, data and video applications. 2.2 Evaluate critically a range of networking strategies that will enable integration of networking techniques with business environment. 2.3 Design a solution to a complex traffic management problem using the advanced features of network system technology. 2.4 Implement the effectiveness of switching and routing processes. 2.5 Deploy different architectures for wired wireless and cellular (voice) networks.

LO3: Evaluate networking engineering systems and run various operations in the networking field with high level of professionalism.	3.1 Develop networking solutions for simple business. 3.2 Enhance network infrastructure service in an organization. 3.3 Model a firms wired/wireless network. 3.4 Develop and configure a LAN. 3.5 Simulate network using Packet Tracer. 3.6 Diagnose/troubleshoot networks
LO4. Analyse factors that influence the operations of networking systems engineering within diverse business environments and business situations.	4.1 Acquire appropriate network equipment. 4.2. Communicate business data seamlessly to solve problems. 4.3. Manage process within broad parameter for specific domain and work outputs.
LO5. Demonstrate specialised knowledge of the role of a range of Network Security Engineering Techniques.	5.1 Design networks using appropriate methodologies. 5.2 Communicate effectively by written, visual and oral means. 5.3 Secure physical networks and network packets. 5.4 Hack networks ethically. 5.5 Sniff network packets
LO6. Develop technical skills in critical evaluation, interpretation and use of data through competency in various problem-based research and analysis and uphold engineering heuristics.	6.1. Design, interpret and implement network diagrams. 6.2. Work as a member of a team and demonstrate /show inter-personal skills. 6.3. Manage own time and work to deadlines. 6.4. Numerate to an appropriate professional level. 6.5. Identify personal needs, strengths, and opportunities for improvement.

	6.6. Work as a member of a team and develop a range of complex interpersonal skills.
LO7. Apply specialised basic research skills in devising solutions to familiar and unfamiliar problems in a dynamic ICT sector and networking system engineering.	7.1 Solve business problems using networking. 7.2 Model good professional practice and lead by example (e.g understand code of conduct). 7.3 Set stretching targets. 7.4 Lead a team

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SECTION C	***QUALIFICATION STRUCTURE***				
COMPONENT	***TITLE***	***Credits Per Relevant NCQF Level***			***Total*** ***(Per** Subject/ Course/ Module/ Units)*
		Level [5]	***Level [6]***	***Level [7]***	
FUNDAMENTAL COMPONENT *Subjects/ Courses/ Modules/Units*	Computer Technology	15			15
	Systems Development	20			20
	Computer-Related Mathematics and Statistics	20			20
	Fundamentals of networking	20			20
	Computer Systems Installation and Maintenance	20			20
CORE COMPONENT *Subjects/Courses/ Modules/Units*	Routing and switching fundamentals		20		20
	Innovation project		20		20
	Data Centre Networking		20		20
	Wireless Networking		20		20
	Network Architecture Design		20		20
	Distributed Systems		20		20
	Enterprise networking		20		20
	Network security			20	20

	Industry Attachment			60	60
	Research			25	25
	Product Development			20	20
	Advanced Cyber Security			20	20
	Advanced Routing			20	20
	Ethical Hacking			20	20
	Telecommunications			20	20
ELECTIVE/ OPTIONAL COMPONENT *Subjects/Courses/ Modules/Units*	Introduction to Programming C#		20		20
	Computer Systems Administration		20		20
	Object oriented Analysis and Design with JAVA		20		20

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SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	***Credit Value***
Level 5	***95***
Level 6	***140***
Level 7	***205***
TOTAL CREDITS	***480***
Rules of Combination: ***(Please Indicate combinations for the different constituent components of the qualification)***	
There are 2 electives to be chosen, which are 20 credits each. A qualification will be awarded upon accumulating a minimum of 480 credits.	

ASSESSMENT ARRANGEMENTS

Assessment
All assessments leading to the awarding of this qualification will be based on learning outcomes associated with the following assessment criteria:

1. **Formative assessment**

The weighting of formative assessment is 60% of the final assessment mark.

2. **Summative Assessment**

The weighting of summative assessment is 40% of the final mark.

Assessment arrangements will be done by BQA registered and accredited assessors.

MODERATION ARRANGEMENTS

There shall be provision for internal and external moderation done by BQA registered and accredited Moderators.

RECOGNITION OF PRIOR LEARNING

There will be provision of Recognition of Prior Learning (RPL) for award of the qualification using Institutional RPL Policy i National RPL Policy

CREDIT ACCUMULATION AND TRANSFER

There shall be access and award of credits of the qualification using Institutional Credit Accumulation and Transfer (CAT) National CAT Policy.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Horizontal Learning Pathway*:*

- Bachelor of Science in Networks and Forensics
- Bachelor of Science in Computer Networking Management

Vertical Learning Pathway:

- Bachelor (Honours) in Network Systems Engineering (NCQF Level 8)
- Post Graduate Certificate in Network Systems Engineering (NCQF Level 8).

Employment pathways:

Upon completion of the qualification, graduates can attain jobs in various computing. They could venture into industry as:

- Network and Computer Systems Administrators,
- Computer Programmers,
- Information Security Analysts
- Network specialists.

QUALIFICATION AWARD AND CERTIFICATION

Qualification award:

The minimum number of credits for award of the Bachelor of Science in Network Systems Engineering is 480 credits and s prescriptions in rules of combination.

Certification*:*

Graduates will be awarded a **Bachelor of Science in Network Systems Engineering**. Upon completion graduates will b official transcript and certificate.

REGIONAL AND INTERNATIONAL COMPARABILITY

The qualification was informed by the BSc Network Systems Engineering qualification from University of Sunderland and C

Internationally the qualification is considerably underpinned to University of Sunderland and CISCO.

Regional Comparability:

Regional compatibility was done with the Varsity College - The Independent Institute of Education (The IIE) South Africa. T compared well with modules above 80% similarity, they are both completed in four years of study and modules carry the s credits (20 credits).

International Comparability:

None was found at this level; Bachelor.

Regional Benchmarking

Regional compatibility was done with the Varsity College - The Independent Institute of Education (The IIE) South Africa qualifications compared well with modules above 80% similarity.

Comparison factor	**Proposed Qualification being developed**	**Benchmark** Varsity College - The Independent Institute of Education (The IIE)
Title	BSc Network Systems Engineering (4 Years)	Bachelor of Computer and Information Sciences in Network Engineering (3 Years)
Year of study	Year 1	Year 1
Modules	Computer Technology Systems Development Fundamentals of networking Computer-Related Mathematics and Statistics Routing and switching fundamentals. Computer Systems Installation and Maintenance	Applied Communication Techniques Database Management Systems Computer Fundamentals Introduction to Network Programming Digital Law and Ethics Mathematical Principles for Computer Science Network Engineering 1A Network Engineering 1B Operating Systems 1A Operating Systems 1B Programming Logic and Design (Introduction)
Year of study	Year 2	Year two
Modules	C# Data Centre Networking	Database Management Systems 2 Emerging Network Technologies

	Wireless Networking Network Architecture Design Distributed Systems Research and Innovation project	IT Project Management Network Administration B Network Administration A Network Engineering 2B Network Engineering 2A Wireless and Mobile Communication Web Server Management
Year of study	Year 3	Year three
Modules	Enterprise networking Network security Computer Systems Administration Industry Attachment	Database Management Systems 3 IT Risk Management Enterprise Architecture Network Engineering 3B Enterprise Resource Planning Principles of Information Security Introduction to Research Network Engineering W3 Work Integrated Learning 3
Year of study	Year 4	
Modules	Research Product Development Advanced Cyber Security Advanced Routing Ethical Hacking Telecommunications	

International Benchmarking

The qualification was developed with a focus to equip graduates with top level skills in computer networking. The qualifi informed by the BSc Network Systems Engineering qualification from University of Sunderland and CISCO in general. I qualification is considerably underpinned to University of Sunderland and CISCO.

The qualification was developed following the requirements of Quality Assurance associations such as BQA and Quality Agency to ensure that the skills graduates develop are relevant.

The relevant Quality Assurance Agency for higher education (QAA) subject benchmark statements (Refer to www.qaa.c to the QAA, qualification will go a long way in addressing the scarce skills identified by Human Resource Development C e.g. in ICT. Therefore, the design of the qualification was informed by such.

Comparison factor	**Existing Qualification being developed**	**Benchmark** **Solent University – Southampton**
Title	BSc Network Systems Engineering (Each module 20 credits)	BSc Computer Systems and Network Engineering (Each module 20 credits)
Year of study	Year 1	Year 1
Modules	Computer Technology Systems Development Fundamentals of networking Computer-Related Mathematics and Statistics Routing and switching fundamentals.	Problem Solving though Programming. Introduction to Networks and Security Network Applications Introduction to Databases Routing and Switching

	Computer Systems Installation and Maintenance	Cyber Security Essentials
Year of study	Year 2	Year two
Modules	C# Data Centre Networking Wireless Networking Network Architecture Design Distributed Systems Research and Innovation project	Network Systems Automation Scaling Networks Network Security Research Methods Project Connecting Networks Network Implementation
Year of study	Year 3	Year three
Modules	Enterprise networking Network security Computer Systems Administration Industry Attachment	Dissertation Project Computer Systems and Architecture Industrial Consulting Project
Year of study	Year 4	
Modules	Research Product Development Advanced Cyber Security Advanced Routing	**Choose two options from the following:** Cyber Ops Cloud Computing and Virtualisation

	Ethical Hacking Telecommunications	Network Management Internet of Things

Regional Benchmarking

None found at this level, Bachelor. University of Sunderland has the Qualification as BSc (Hons) Network Systems.

The Qualification is informed by the BSc Network Systems Engineering qualification from University of Sunderland and Internationally the qualification is considerably underpinned to University of Sunderland and CISCO.

REVIEW PERIOD

Every five (5) years.