QUALIFICATION SPECIFICATION SECTION A						
QUALIFICATION DEVELOPER	New Era College of Arts, Science and Technology					
TITLE	Diploma in Computer Engineering			**NCQF LEVEL**	6	
FIELD	Manufacturing, Engineering and Technology		**SUB-FIELD**	Computer Engineering		
NEW QUALIFICATION	✓	**REVIEW OF EXISTING QUALIFICATION**				
SUB-FRAMEWORK	General Education		TVET	✓	Higher Education	
QUALIFICATION TYPE	Certificate		Diploma	✓	Bachelor	
	Bachelor Honours		Master		Doctor	
CREDIT VALUE					262	

RATIONALE AND PURPOSE OF THE QUALIFICATION

RATIONALE:

1 The requirement for developing this qualification emanated from a labour market survey done by HRDC the nation's human resource development agency which identified the need for computer technicians who are able to provide broad solutions and services through analysis, design, evaluation, implementation, deployment and coordination of problems and services needed in the domain of computer engineering according to the Human Resource Development Council (HRDC) Top 20 Occupation report,(HRDC Top 202 occupations, 2016).The report highlighted the need for Computer Technician graduates for the ICT industry in Botswana who have the requisite and broad knowledge in the field of computer engineering with capacity to critically think and reflect analytical in the tasks undertaken in the field of computer engineering. The computer engineering technician graduate should also be compounded with skills and competences that enable them to resolve technical and engineering challenges through extensive consultation with relevant stakeholders. The computer engineering technician graduate shall demonstrate the capacity to be innovative and creative in the context of the field of computer engineering and be ethically professional and capacity build to higher levels of learning. In summary the computer engineering technician graduate shall be able to demonstrate competencies like analysis, design, implementation, testing and maintenance of any technical and engineering oriented challenge and also blend with integration and facilitations skills as commended by many Engineering Institutions like Botswana Institute of Engineers, Engineering

Council of Southern Africa (ECSA).The following **national strategic plans and policies** underpins the development of computer engineering skills in Botswana:

1.1 Computer engineering skills set are needed as informed by the Botswana National Strategic Development Plans 9, 10 and 11 (NSDP) and the Vision 2036 plan because they create an ICT environment which provides a much needed atmosphere for the Botswana economy to prosper. Computer engineering skills will ensure an unfettered access and ease of flow of information through modern technology and will attract big companies to invest into Botswana resulting in job creation, income generation and asset base expansion (Botswana Mid-Term Review NDP10, P.48 & P.49, 2013).

1.2 Botswana's National ICT Policy, dubbed the Maitlamo ICT Policy states that the National ICT Policy will position Botswana for sustained growth in the digital age. ICT technology will serve as a key catalyst in achieving social, economic, political and cultural transformation within Botswana therefore realize a Botswana knowledgeable economy and information society. However this drive requires the infusion of skills like computer engineering which basically provide the ICT expertise for sustenance and creation of an information society with ICTs like Homes and community, Healthcare, Learning, Government, Infrastructure, Marketplace (p.3) according to the target of the Maitlamo ICT policy.

1.3 The National Development Plan 11 (2011-2016) clearly makes explicit the need for manpower development for ICT skills in Computer engineering and enlightens that "… training of ICT personnel will continue to be accorded priority in order to enhance the sector's contribution to economic and export diversification, as well as the creation of high quality jobs."(p.80) and this strategic intuition is further confirmed by HRDC's Top 20 occupation of priority in the sector of Information and Communication Technology by the (HRDC TOP OCCUPATIONS IN HIGH DEMAND report, December 2016) that Computer engineering graduates with this skills are needed.

1.4 Botswana Vision 2036 strategic plan spells out ICT as a critical service sector which is contributing to the country's GDP and employment creation and graduates with Computer engineering skills are playing a critical role in ensuring development and availability of computer systems and their

maintenance, sourcing and management to service key sectors like tourism, agriculture, mining and others. Vision 2036 strategic plans clearly specifies that "…ICT sector contributes significantly to the economy…efficient enabler of product and service delivery across all economic sectors in the delivery of government services"(p.27)

1.5 In summary Computer engineering skills have been identified and justified by the Botswana industry as further qualified and justified by the Human Resource Development Council (HRDC) top priority occupations for industry of Botswana. In summary Computer Engineering has been clearly stated as a Top 20 occupation of priority in the sector of Information and Communication Technology by the HRDC TOP OCCUPATIONS IN HIGH DEMAND report (December 2016).

PURPOSE:

The purpose of the Qualification in Computer Engineering is to produce people with advanced knowledge, skills and competencies to:

- Execute ICT industrial tasks related to analysis, design, implementation, deployment and maintenance of computer technology equipment and infrastructure using techniques, theories and methodologies of computer engineering.
- Take responsibility and accountability of work done in a computer engineering or multipurpose project.
- Perform system simulation, modelling, and technical documentation when solving industrial problems.
- Track costs associated with project design and part procurement for computer system design.
- Observe the ethical and professional codes of the ICT industry.
- Collaborate with other engineers of various disciplines towards solving complex engineering issues.

ENTRY REQUIREMENTS (including access and inclusion)

2.1 Entry Requirements:

2.1.1 Minimum entry requirements

- Certificate IV, NCQF Level 4 (BGCSE or equivalent).

2.1.2 Recognition of Prior Learning (RPL) and Credit Accumulation and Transfer (CAT)

An applicant who does not meet minimum entry requirements stated above may be considered on RPL and CAT in line with the relevant ETP and national policies.

QUALIFICATION SPECIFICATION SECTION B	
GRADUATE PROFILE (LEARNING OUTCOMES)	**ASSESSMENT CRITERIA**
3.1 **Formulate** computer system solutions in context of people, knowledge, technologies and in the field of computer engineering	1.1.1 Apply mathematics and science concepts for analysis and design for computer software, hardware and systems. 1.1.2 Design computer systems that would solve and fit within a composite project which would require computer engineering solutions. 1.1.3 Install a computer system based on clientele design specifications from software, hardware and network perspective 1.1.4 Deploy and commission computer systems for various industrial and engineering functions. 1.1.5 Document commissioned computer system for future reference and maintenance.
3.2 **Design** computer system which are based on software, hardware and networking technologies for commercial, industrial, medical, military, or scientific applications and evaluate their performance.	3.2.1 Develop according to software to create computer systems models for specified clientele requests 3.2.2 Evaluate relevant hardware, software and network components for creating computer systems. 3.2.3 Maintain and configure a computer system based on a designed model. 3.2.4 Modify and upgrade computer based on new industrial requirements *3.2.5* Communicate and inform on needed computer system functionality using models.
3.3 **Justify** maintenance and testing tools for use during systematic maintenance, calibration and measuring of computer	3.3.1 Identify appropriate tools for analysis and maintenance of computer systems.

systems for industrial and engineering applications	3.3.2 Calibrate measuring and testing tools for up keeping computer equipment in workshop. 3.3.3 Monitor computer system operation and optimise its operation by adjusting and setting relevant operational parameters using provided standards 3.3.4 Compute statistical functional elements of a computer system and report on operational status and recommend any modifications. 3.3.5 Simulate functional operation of deployed computer systems and note discrepancies for purposes of maintenance and calibration 3.3.6 Evaluate all testing and measuring equipment for electrical and electronic maintenance. 3.3.7 Select appropriate and relevant electrical and electronic measuring equipment for maintain computer systems. 3.3.8 Apply key functional skills in electronics and electrical engineering to test and measure Electrical & Electronic equipment 3.3.9 Interpret electronic and electrical values in measuring and measurement of Electrical & Electronic equipment 3.3.10 Service Electrical & Electronic equipment using electronic and electrical datasheets for replacement of components and devices.
3.4 **Develop** software for computer systems and test their functionality based on industrial specifications and requirements.	3.4.1 Develop software codes or software patches to upgrade functionality of computer system functionality. 3.4.2 Upgrade installed software in computer systems for enhanced functionality. 3.4.3 Install and configure using software computer systems parts from different vendors or the same manufacturer to build a functional computer system for a given industrial task

	3.4.4 Trouble shoot complex computers systems using intelligent devices 3.4.5 Interpret and maintain complex computer systems using auto generated reports from intelligent monitoring devices
3.5 **Troubleshoot** computer systems network using networking and telecommunications concepts to attain integrated system functionality with shared resources for industrial purposes.	3.5.1 Evaluate different networking topologies to effectively network given computer systems for purposes of resources sharing and interchange based on clientele requirements. 3.5.2 Infuse network and telecommunication technologies to geographical integrate computers systems spatially located. 3.5.3 Test functionality and optimisation of networked systems for further improvement. 3.5.4 interpret recorded operational parameters of networked computers systems to make informed decisions on expansion and upgrading 3.5.5 Monitor functionality of networked computers systems and communicate the operational status of the systems.
3.6 **Communicate** on possible knowledge in deriving models for computer by applying complex numerical, scientific and engineering models.	3.6.1 Work in group by practicing all facets of communication like negotiation, listening and presenting skills 3.6.2 Convey project objectives and schedule along with updates to business teams 3.6.3 Utilize different tools for creating software project reports or documents such as Word Processors, Excel, Unified Modelling Language and PowerPoint, Project Management Software, Visio etc.
3.7 **Register** with practicing regulatory authorities in computer engineering field for purpose of professional practice.	3.7.1 Practice professional ethics in discipline and register 3.7.2 Create conscience in ethical practice and liaise with subordinates

	3.7.3 Apply principles of ethical and professional practice in conducting E&E engineering activities in particularly when dealing with different clients 3.7.4 Sensitize and respect cultural norms of various eco systems related to area of occupation and location 3.7.5 Abide to legal statues to guide the operations and conduct of E&E engineering duties in any given context. 3.7.6 Respect and honour working relationships od subordinates and superiors to maintain good working relationships in any give working environment

QUALIFICATION STRUCTURE **SECTION C**			
FUNDAMENTAL COMPONENT Subjects / Units / Modules /Courses	**Title**	**Level**	**Credits**
	Introduction to Computing	5	12
	Computer Engineering	5	24
	Computer Architecture	5	12
CORE COMPONENT Subjects / Units / Modules /Courses	Electrical & Electronics Engineering courses	6	12
	Systems & Hardware Hardware & Embedded Systems Parallel and Distributed Computer system	6	48
	Engineering Mathematics	6	8
		6	24
	Engineering Science	6	8
		6	20
	Information and Communication Technology	6	12

	Data Algorithms Digital Computer Programming Computer Programming	6	24
	Professional Practice	7	8
	Engineering Ethics	6	30
	Industrial Attachment	7	12
ELECTIVE COMPONENT Subjects / Units / Modules /Courses	Network Security (Systems & Networks)	7	8
	Real time Systems (Advanced Hardware & Embedded Systems)	7	8

Rules of combinations, Credit distribution (where applicable):

Credit Distribution is defined by the following table:

Credit distribution rules for the qualification are defined in relation to the relevant **NCQF level 6 and constituent NCQF** level descriptors below. The qualification in Computer Engineering credits are determined in line with qualifications structure to derive the credits required which is **262** credits.

Qualification Combination Rules Based on Module Status per NCQF designation of:

Fundamental, Core & Electives

- Fundamental Level 5 48 Credits
- Core Level 6 186 Credits
- Core Level 7 20 Credits
- Elective Level 7 8 Credits (Students choose 1)

Total 262 Credits

ASSESSMENT AND MODERATION ARRANGEMENTS

Assessment Arrangements

Learners shall be evaluated based on summative evaluation approach which considers attainment of qualification learning outcomes. The formative evaluation approach which has also considers attainment of modules learning outcomes.

Formative and Summative Assessment Weightings

Formative assessment or continuous assessment contribute to **40%** of the final grade.

The summative assessment contribute to **60%** of the final grade.

Moderation.

There is provision for internal and external moderation as a quality assurance measure.

Assessors and Moderators must be suitably qualified and experienced subject matter experts and they should also be registered with BQA as Assessors and/or moderators.

RECOGNITION OF PRIOR LEARNING (if applicable)

Recognition of Prior Learning (RPL)

1. RPL and CAT will be applicable for award of this qualification or credits towards award of part qualifications thereof.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Learning Pathways

Horizontal articulation of the qualification (NCQF Level 6)

- Diploma in Electronics Engineering
- Diploma in Telecommunications Engineering
- Diploma in Electrical and Electronics Engineering
- Diploma in Networking Engineering
- Diploma in Software Engineering

Vertical articulation of the qualification (NCQF Level 7)

- Bachelor of Engineering in Electronics Engineering
- Bachelor of Engineering in Telecommunications Engineering
- Bachelor of Engineering in Electrical and Electronics Engineering
- Bachelor of Engineering in Networking Engineering
- Bachelor of Engineering in Software Engineering

Employment Pathways

Graduates of the programme may find employment in a range of public and private organisations for the following posts.

Typical roles include in Computer Engineering domains and those related as

- Computer Assistant Engineer,
- Computer Technician,
- Computer Engineering Consultant,
- Computer Salesperson
- Computer Marketing Person
- Computer Engineering Teacher
- Hardware Technician
- System Technician
- Software Technician
- Network Technician

QUALIFICATION AWARD AND CERTIFICATION

To be awarded a **Diploma in Computer Engineering**, a candidate must attain 262 credits and satisfy the rules of combination prescribed above.

REGIONAL AND INTERNATIONAL COMPARABILITY

Summary of Benchmarking with other Institutions

Table: Benchmarking of Diploma in Computer Engineering with Other University /Colleges Institutions

	184 Credit Hour	480 credits 10 Notional hrs. /Credit	480 credits 10 Notional hrs. /Credit
	Objective Based Qualification	Learning Outcome Based Qualification	Learning Outcome Based Qualification
	▪ Electrical ▪ Electronics ▪ Computing ▪ Prof Practice ▪ Math Eng. ▪ Telecommunication	▪ Electrical ▪ Electronics ▪ Computing ▪ Prof Practice ▪ Math Eng.	▪ Electrical ▪ Electronics ▪ Computing ▪ Prof Practice ▪ Math Eng.
	▪ Laboratory ▪ Practical's ▪ Group Work ▪ Examination ▪ Test	▪ Laboratory ▪ Practical's ▪ Group Work ▪ Examination ▪ Test	▪ Test ▪ Assignments ▪ Final Examination ▪ Continues Evaluation ▪ Projects

Regional comparability : Similarity, Differences

Similarities

- All qualifications cover almost all knowledge areas in the domain of computer engineering

- Fair distribution of learning outcome based and objective learning based

Differences

- Not all diploma qualification use the notional 10 hour learning
- The total credits awarded at the completion of the qualification are different

Contextualization

The qualification is contextualised by benchmarking the areas stated above and as follows

- The qualification shall adopt the qualifications learning outcome like a majority of the universities and this in line with the BQA NCQF.

Generalisation

The qualification based on the similarities and minor differences determined it is portable and generalizable within the regional Universities.

International comparability : Portability Generalisation of the Programme

	Learning Outcome Based Approach	Objective Based Outcome	Learning Outcome Based Approach	Objective Based Outcome
	▪ Electrical ▪ Electronics ▪ Computing ▪ Prof Practice ▪ Math Eng. ▪ Eng. Science ▪ Artificial Intelligence	▪ Electrical ▪ Electronics ▪ Eng. Science ▪ Computing ▪ Prof Practice ▪ Math Eng. ▪ Linguistics	▪ Electrical ▪ Electronics ▪ Computing ▪ Prof Practice ▪ Math Eng. ▪ Eng. Science	▪ Electrical ▪ Electronics ▪ Computing ▪ Prof Practice ▪ Math Eng. ▪ Eng. Science

	▪ Research Project ▪ Listening Assessment ▪ Presentation ▪ Final Examination ▪ Individual Presentation	▪ Experiments ▪ Lab Assessments ▪ Midterm –Test ▪ Examination ▪ Report ▪ Presentation ▪ Attendance	▪ Laboratory ▪ Practical's ▪ Group Work ▪ Examination ▪ Test	▪ Laboratory ▪ Practical's ▪ Group Work ▪ Examination ▪ Test

International comparability: Similarity, Differences, Portability and Generalisation.

Similarities

- All qualification emphasizes on learning outcome based approach.
- All qualifications offer similar knowledge areas
- The National Qualification Level is a diploma.
- Majority of qualifications use the learning outcome based approach

Differences

- Not all computer engineering qualification use the notional 10 hour learning to calculate credits
- The total credits awarded at the completion of the qualification are different because of the credit framework used

Contextualization

The qualification is contextualised by benchmarking the areas stated above and as follows

- The National Qualification Level shall be diploma
- The qualification shall adopt the qualifications learning outcome like a majority of the universities and this in line with the BQA NCQF.

Generalisation

The qualification based on the similarities and minor differences determined it is portable and generalizable within the international Universities.

REVIEW PERIOD
Every after 5 years in line with the NCQF.