SECTION A:	***QUALIFICATION DETAILS***															
QUALIFICATION DEVELOPER (S)	New Era College of Arts, Science and Technology															
TITLE	Bachelor in Computer Systems Engineering (Honours)											***NCQF LEVEL***	8			
FIELD	Information and Communication Technology		***SUB-FIELD***		Computer Engineering							***CREDIT VALUE***	605			
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

1.1 ***Rationale for the Qualification:***

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 engineers who are able to provide 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 reports 2020 and 2016.The report highlighted the need for Computer Engineering graduates for the ICT industry in Botswana who have the requisite and profound 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 as planned in the following policy and strategic planning reports.

a) Computer engineering skills set are needed as informed by the Botswana National Strategic Development Plans 9, 10 and 11 (NSDP) and the Vision 2036, and Botswana's National ICT Policy Vision 2036 (2016), 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).

b) The Botswana National ICT Policy, Maitlamo Policy informs on the Vision and Objectives of the country that "Botswana will be a globally competitive, knowledge and information society where lasting improvements in social, economic and cultural development is achieved through effective use of ICT". 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.

c) 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). There is need for computer engineering expertise who will form the baseline skills for the drive force behind economy diversification and thus creating a knowledge-based economy and a vibrant information society.

d) The HRDC Top Occupations in High Demand Report (2016 and 2020) confirms the National Development Plan 11 (2011-2016) strategic intuition by calling for development of computer engineering specialist. These computer engineering skills will facilitate computer engineering experts who are trained as Information Technologist, Digital Transformation Specialists, Machine Learning Specialist, and Process Automation Specialist. This initiative strengthens the government's plans for adoption and embracement of the 4th industry revolution technology in facilitating SMART technologies hence knowledge based economy and vibrant information society

e) 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)

PURPOSE:

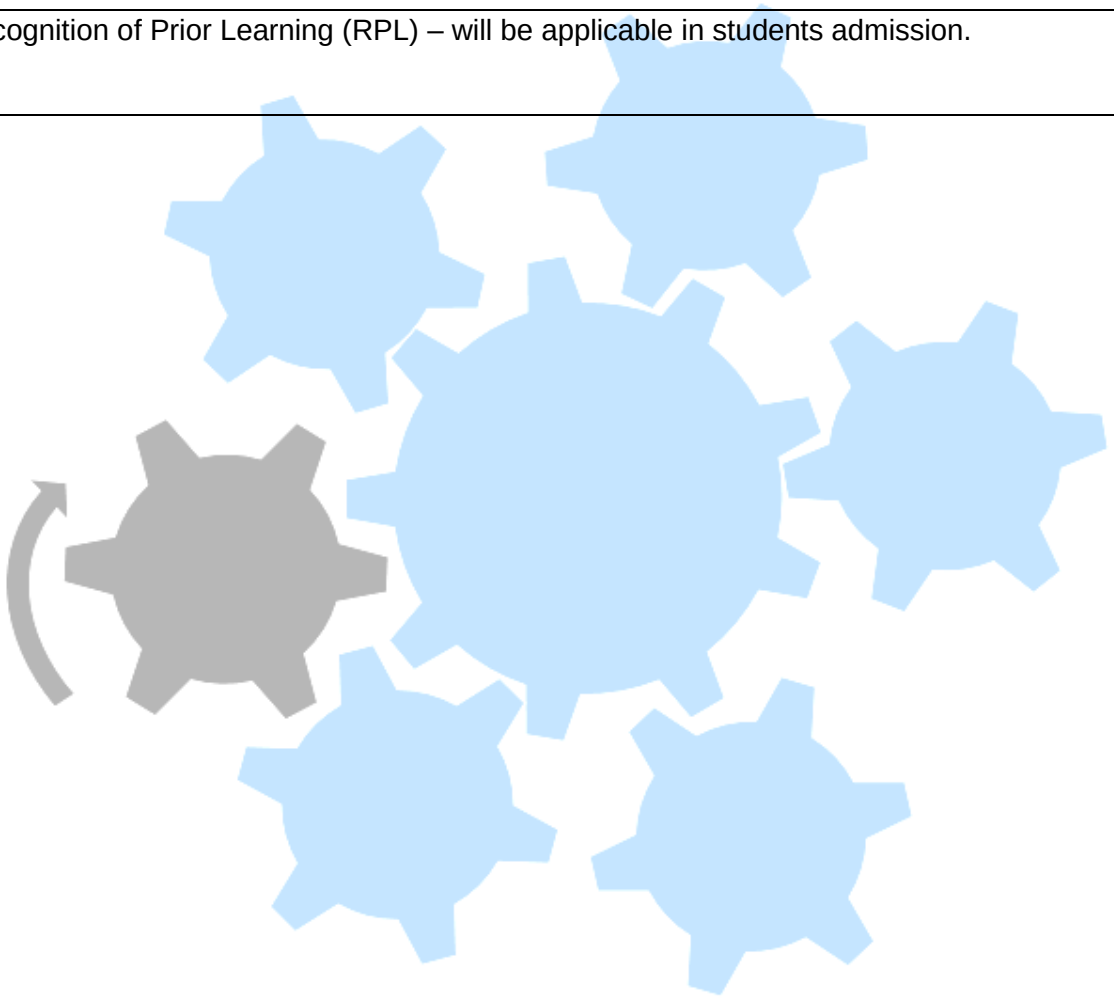
The purpose of the qualification is to develop Computer System Engineers with the knowledge, skill, and competence to:

- Engage in critical thinking, problem solving and analytical skills to solve computer engineering problems in the industry and community through analysis, design, implementation, deployment, and maintenance of computer engineering systems i.e., digital transformation systems, machine learning systems, process automation systems.
- Apply creative and innovative skills to originate new ideas and concepts in computer engineering solutions to solve industrial problems and needs through system simulation, modelling, and technical documentation and create SMART technologies
- Observing ethical and professional codes in computer engineering industry and cooperate with other engineers of various disciplines towards solving complex engineering issues
- Implement acquired computer engineering skills-sets in technical knowledge, skills, and competence for purposes of conducting applied research in the computer engineering field, to solve industrial and national problems that require automation.
- Take charge of responsibility and accountability of work done in any computer engineering or multipurpose project.
- Commit to attaining lifelong learners skills as required in the field of computer systems engineering

ENTRY REQUIREMENTS (including access and inclusion)

- NCQF Level IV Certificate best 6 subjects and passes in English, Mathematic and a Science subject

- Recognition of Prior Learning (RPL) – will be applicable in students admission.



SECTION B	***QUALIFICATION SPECIFICATION***
GRADUATE PROFILE (LEARNING OUTCOMES)	***ASSESSMENT CRITERIA***
1. Develop computer system solutions in context of people, knowledge, technologies and in the field of computer engineering .	1.1. Apply mathematics and science concepts for analysis and design for computer software, hardware, and systems. 1.2. Design computer systems that would solve and fit within a composite project which would require computer engineering solutions. 1.3. Install a computer system based on clientele design specifications from software, hardware, and network perspective 1.4. Deploy and commission computer systems for various industrial and engineering functions. 1.5. Document commissioned computer system for future reference and maintenance
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.	2.1. Develop according to software to create computer systems models for specified clientele requirements. 2.2. Evaluate relevant hardware, software, and network components for creating computer systems per OEM standards. 2.3. Maintain and configure a computer system based on a designed model. 2.4. Modify and upgrade computer based on new industrial requirements 2.5. Communicate and inform on needed computer system functionality using models.
3. Justify maintenance and testing tools for use during systematic maintenance, calibration and measuring of computer systems for industrial and engineering applications	3.1. Identify appropriate tools for analysis and maintenance of computer systems. 3.2. Calibrate measuring and testing tools for up keeping computer equipment in workshop. 3.3. Monitor computer system operation and optimize its operation by adjusting and setting relevant operational parameters using provided standards

	3.4. Compute statistical functional elements of a computer system and report on operational status and recommend any modifications. 3.5. Select appropriate and relevant electrical and electronic measuring equipment for maintain computer systems
4. Develop software for computer systems and test their functionality based on industrial specifications and requirements.	4.1. Develop software codes or software patches to upgrade functionality of computer system functionality. 4.2. Upgrade installed software in computer systems for enhanced functionality. 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 4.4. Trouble shoot complex computers systems using intelligent devices 4.5. Interpret and maintain complex computer systems using auto generated reports from intelligent monitoring devices
5. Troubleshoot computer systems network using networking and telecommunications concepts to attain integrated system functionality with shared resources for industrial purposes.	5.1. Evaluate different networking topologies to effectively network given computer systems for purposes of resources sharing and interchange based on clientele requirements. 5.2. Infuse network and telecommunication technologies to geographical integrate computers systems spatially located. 5.3. Test functionality and optimization of networked systems for further improvement. 5.4. interpret recorded operational parameters of networked computers systems to make informed decisions on expansion and upgrading 5.5. Monitor functionality of networked computers systems and communicate the operational status of the systems
6. Integrate microprocessor microcontrollers and digital devices to create new computers systems for solving problems based various industrial need.	6.1. Evaluate and inform on relevant microprocessor/microcontrollers and digital and software needed for new computer systems based on emerging problems in an industrial environment.

	6.2. Specify microprocessor/microcontrollers and digital and software specifications for implemented computer systems to operate smoothly 6.3. Install and configure appropriate and relevant microprocessor/microcontroller devices to facilitate new computer systems development and implementation for identified problems
7. Create computer engineering solutions to unfamiliar ill-defined problems including the choice of technology and possibly either discipline such as Information and Communication Technology, Civil engineering projects, Telecommunications Engineering	7.1. Work in multidiscipline project where computer system engineering solutions are needed 7.2. Integrate seamlessly the functionality of computer system solutions with other engineering disciplines 7.3. Implement sound and feasible computers system solutions in multi-disciplined projects
8. Communicate on possible knowledge in deriving models for computer by applying complex numerical, scientific, and engineering models.	8.1. Communicate inter and intrapersonal during interaction with audience 8.2. Write research reports and defend 8.3. Work in group by practicing all facets of communication like negotiation, listening, and presenting skills 8.4. Convey project objectives and schedule along with updates to business teams 8.5. Differentiate different tools for creating software project reports or documents as in Word Processors, Excel, Unified Modelling Language and PowerPoint, Project Management Software, Visio etc.
9. Research in industry related technologies through applying relevant problem solving and critical thinking skills	9.1. Solve computer engineering problems using appropriate and scientific technologies 9.2. Apply relevant research methodologies in conducting computer engineering research to produce publishable research documents 9.3. Attend research conferences, workshop and seminars with a view to stay updated on latest technologies, theories and methodologies in computer engineering and any other emerging technologies

	9.4. Publish research articles on existing and emerging issues in computer engineering in order to create new knowledge and to provide solutions to running problems.
10. Observe cultural, ethical, and professional matters that prevail and govern given environment in the best interest of working with all stakeholders in developing computer networking solutions	10.1. Practice professional ethics in discipline and register 10.2. Create conscience in ethical practice and liaise with subordinates 10.3. Apply principles of ethical and professional practice in conducting computer engineering activities in particularly when dealing with different clients 10.4. Sensitize and respect cultural norms of various eco systems related to area of occupation and location 10.5. Abide to legal statues to guide the operations and conduct of computer engineering duties in any given context. 10.6. Respect and honor working relationships od subordinates and superiors to maintain good working relationships in any give working environment
11. Manage small to medium computer engineering projects demonstrating fundamental knowledge and insight work ethics and managerial functions that constitute good engineering practice	11.1. Manage small projects like research project 11.2. Interact with other stakeholders in research projects 11.3. Manage time and account for delivery

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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]***	***Level [8]***	
FUNDAMENTAL COMPONENT	End User Computing	*10*				*10*
	Engineering Mathematics I	*10*				*10*

Subjects/ Courses/ Modules/Units	Engineering Science I	*10*				*10*
	Professional Communication Skills for Engineers	*10*				*10*
	Engineering Drawing	*10*				*10*
	Introduction to Programming Principles	*10*				*10*
	Engineering Mathematics II		*10*			*10*
	Engineering Science II		*10*			*10*
	Engineering Ethics	*10*				*10*
	Engineering Mathematics III			*10*		*10*
	Computer and Hardware Workshop				*10*	*10*
	Engineering Mathematics IV			*10*		*10*
	Industrial Placement			*50*		*50*
	Research Methods in Engineering				*10*	*10*
	Engineering Mathematics V			*10*		*10*
	Entrepreneurship and Economic Development			*10*		*10*
	Project Management for Engineers			*10*		*10*
	Network Fundamentals	*15*				*15*

CORE COMPONENT *Subjects/Courses/ Modules/Units*	Computer Architecture and Organization				*10*	*10*
	C++ Programming		*15*			*15*
	Introduction to Python Programming		*15*			*15*
	Human Computer Interaction				*10*	*10*
	Operating Systems		*10*			*10*
	Optical Communication				*10*	*10*
	Signals and systems			*15*		*15*
	Structured Programming using C		*15*			*15*
	Digital System Design			*15*		*15*
	Digital Signal Processing				*15*	*15*
	Group Project			*15*		*15*
	Computer Security				*10*	*10*
	Java Programming		*15*			*15*
	Embedded Systems Design				*15*	*15*
	Database development and management				*15*	*15*
	Network Engineering				*15*	*15*
	Data Structures and Algorithms		*10*			*10*

	Multimedia Compression Techniques		*10*			*10*
	Data Communication and Networks			*10*		*10*
	Measurement Systems				*15*	*15*
	Microprocessor & Microcontrollers				*15*	*15*
	Individual Project Part I (Computer Engineering Project)				*15*	*15*
	Individual Project Part II (Computer Engineering Project))				*15*	*15*
	Digital Electronic Systems			*15*		*15*
	Software Engineering		***10***			*10*
ELECTIVE/ OPTIONAL COMPONENT *Subjects/Courses/ Modules/Units*	Artificial Intelligence			***10***		*10*
	Robotics Technology					
	Internet of things			*10*		*10*
	Cloud Computing					
	Network Security			*15*		*15*

	Cyber Security					
	Mobile Application Development			15		15
	Web Application Development					

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SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	***Credit Value***
NCQF Level 5 Modules	*85*
NCQF Level 6 Modules	*120*
NCQF Level 7 Modules	*220*
NCQF Level 8 Modules	*180*
TOTAL CREDITS	***605***

Rules of Combination:

(Please Indicate combinations for the different constituent components of the qualification)

The qualification rules constitute a combination of:

(a) Elective modules

(b) Core modules which are compulsory

(c) Fundamentals modules which are also compulsory

(d) To graduate a candidate should have completed 605 credits

Qualification Combination Rules Based on Module Status per NCQF designation of: Fundamental, Core & Electives:

- Core modules have **330** credits
- Fundamental modules have **225** credits
- Elective modules (Choose **FOUR** modules out of **EIGHT**) have **50** credits

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ASSESSMENT ARRANGEMENTS

1.1. Assessment Arrangements

Learners shall be evaluated based on summative and formation evaluation approach which considers attainment of qualification learning outcomes.

1.2. Assessment Strategies, Requirements and Weightings

All assessments, formative and summative, leading/contributing to the award of credits or a qualification should be based on learning outcomes and/or sub-outcomes.

1.2.1. Formative assessment

(a) Formative assessment or continuous assessment contributing towards the award of credits should be based on module learning outcomes.

(b) The formative assessment methods for this qualification are by:

1. Test
2. Assignment.
3. Workshop practice
4. Computer lab practice
5. Group assessment

(c) The contribution of formative assessment to the final grade is **40%**

1.2.2. Summative assessment

(a) Summative assessments contributing towards the award of credits should be based on exit programme learning outcomes.

(b) Candidates may undergo assessment including written final examination for each module which contributes 40 % of the final mark for that module.

(c) The contribution of summative assessments to the final grade is 60%

1.3. Module Grading

(a) To pass a module, a final combined mark (summative +formative) of 50% each is required.

(b) To pass the academic individual project, final summative mark of 40% from individual project proposal and 60% from final individual project is required.

1.4. Alternative Assessment Arrangements

There should be a **Special Needs Unit** whose responsibilities are sorely but not limited to;

(a) Dealing with arrangements for students who may need additional support and/or access needs

(b) Coordinating reasonable adjustments to assessment arrangements available

(c) Identifying special needs students during application/admission process

MODERATION ARRANGEMENTS

1.1. Moderation Arrangements

The following shall apply for both internal and external moderation in accordance with applicable ETP policies and regulations:

Internal and External Moderation

In conducting the internal and external moderation the following personnel should be appointed for the tasks:

- Internal and External moderators must hold similar qualification or from the same family of qualifications, at one level above the qualification Bachelor in Computer System Engineering (Honours).
- Minimum of two years relevant experience.
- Internal moderation shall be done by appointed and selected institution assessors and moderators who have been registered with BQA as certified and accredited assessors and moderators or simply by qualified persons.
- External moderation to be done with external moderators from other institutions or industry. External moderators should be accredited with BQA as moderators. The external moderation is done with assistance of internal moderators who should provide all logistical and operational requirements per external moderators' requests and based on the ETP moderation and assessment policy.

RECOGNITION OF PRIOR LEARNING

- RPL will be applicable in gaining credits towards the qualification.

CREDIT ACCUMULATION AND TRANSFER

CAT will be applicable in gaining credits towards the qualification.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

1. Learning Pathways

Horizontal articulation of the qualification

- BEng. (Honours) in Electronics Engineering
- BEng. (Honours) in Telecommunications Engineering
- BEng. (Honours) in Network Engineering
- BEng. (Honours) in Electrical and Electronics Engineering
- BEng. (Honours) in Software Engineering

Vertical articulation of the qualification

- MEng. Electronics Engineering
- MEng. Telecommunications Engineering
- MEng. Network Engineering
- MEng. Computer Systems Engineering
- MEng. Software Engineering

2. Employment Pathways

Graduates of the course 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

- Application Engineer
- Computer Support Engineer
- Customer Service Engineer
- Engineering Specialist
- Computer Sales Engineer
- Computer Test Engineer
- Internet of Things Engineer

QUALIFICATION AWARD AND CERTIFICATION

The qualification in **Bachelor in Computer System Engineering (Honours)** is awarded to a candidate who must attain 605 credits in order to graduate. The following conditions of attaining credits for graduation should be fulfilled.

- Elective modules shall have a total of 50 credits
- Core modules for the qualification should contribute a compulsory and minimum of 330 credits
- Fundamentals modules shall consist of compulsory and minimum of 225 credits
- To graduate a person should have completed 605 credits

REGIONAL AND INTERNATIONAL COMPARABILITY

1. Regional and International Comparability

The qualification is regionally and internationally compatible and transferable on the strength of 95% to 100% similar learning domains in the qualification Bachelor in Computer System Engineering (Honours). It covers most of the Computer Engineering domain being natural sciences, digital hardware, computer networks, computer systems, robotics & control, systems programming, math courses, computing algorithms, information security, and signal processing, Social Sciences, strategies for emerging technologies, signal processing, software engineering and professional practice. Some areas dealt with include 4th industry revolution technologies like cloud commuting, Internet of Things, Artificial Intelligence etc. The qualification does share the same national qualification level which is NCQ level 8 with a majority of the qualifications. The assessment strategies all emphasis workplace (Internship) and embrace a drilldown on practice of the trade to enhance kills and competencies. Refer to the regional and international qualification comparability matrix.

Similarities

- All qualifications consider 95% of the main domain knowledge, competencies, and skills as centred on signal processing, digital logic, computer programming, natural sciences, electrical and electronics, computer networking, emergent technologies, professional practices.
- All qualifications consider industrial experience or internship as important before graduation.
- All qualifications consider dissertation or research as critical for skill acquisition to outright skills in computer engineering.
- All qualifications consider emerging technologies in computer engineering.
- All qualifications converge on the same employment pathways.
- All Qualifications are based on qualifications framework.

Differences

- The total credits awarded at the completion of the qualification are different because of the different credit framework.
- Qualifications have different names however they are address the same concept or learning focus.

Comparability and articulation of the proposed qualification with the ones examined

Contextualization

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

- The qualification also ensures registration of graduates with the local engineering board – Engineers Registration Board upon completion of the study.
- The qualifications adopted elective as means of co-opting specialization according to a majority of the universities.
- The qualification puts emphasis on professional practice to build competency through internship attachment, and practice.
- The qualification provides specialised professional competency to serve in Computer Process Automation field, Digital Transformation specialist field, Computer service Engineering and Computer system Engineering fields.

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, when a complete cycle of the programme is achieved and by then there would be a number of alumina in industry who can also participate in the evaluation of the programme.