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SECTION A: QUALIFICATION DETAILS													
QUALIFICATION DEVELOPER (S)		BOTHO UNIVERSITY											
TITLE	Bachelor of Engineering in Electronics and Communication Engineering										NCQF LEVEL	8	
FIELD	Manufacturing, Engineering and Technology			SUB-FIELD		Electronics and Communication Engineering				CREDIT VALUE	600		
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: Botswana is a fast-developing country, where telecommunication plays a vital role. Due to increasing number of industries, mines, development in the infrastructure and rural electrification, there is a large demand for easy communication. To fulfill this demand the government and the private sector are creating avenues for cheap reliable communication systems. The local industry comprises of land-based telephone companies such as the Botswana Telecommunication Corporation (BTC) and mobile based companies such as Mascom, BeMobile, BBI and Orange. This qualification prepares Electronics and Communication Engineering graduates for the local as well as international markets.													

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Botswana seeks, among other development imperatives, to have an innovative, prosperous and productive nation with a youth endowed with technical skills and competencies. Furthermore, and through its Vision 2036, Botswana envisages to be a knowledge economy aligned with the global agenda for sustainable development. This qualification forms part of the foundation for the realization of the aforementioned vision by providing the nation with competent Electronics and Communication Engineers.

The institution in collaboration with a local agency, conducted a detailed market survey, with a view to sample stakeholders' perceptions and opinions regarding the market demand for B.Eng. in Electronics and Communication Engineering qualification. The responses are, the overall demand for this qualification is high as the prospective students rated 75.1%, current students 81.0%, Employers 70.0% and Parents 30% also it is evident through the literature review, that the Electronics and Communication Engineering qualification has a high demand as it was identified as a critical skills area in Botswana. This points towards the existence of high market demand for B.Eng in Electronics and Communication Engineering qualification.

The Human Resource Development Council (HRDC) Priority skills (Current and Future) document states that there is a high demand for human resources in Engineering. The occupations related to the B.Eng. in Electronics and Communication Engineering qualification which are mentioned in the HRDC Priority skills document is Telecommunications Engineers, Systems administrators, Electrical and Electronic Equipment Assemblers, Control and Instrumentation Engineers, Electronics Engineers, Information technology information system specialist, Industrial Electronics Technicians, Industrial automation Engineers, Computer Network Professional, IT service managers, Aircraft traffic controllers and Air Traffic safety Electronics Technicians, This qualification supplies the Electronics and Communication Engineering graduates, who can be employed for the above-mentioned occupations. Hence it is evident that there is huge demand for Electronics and Communication Engineers.

The fourth industrial revolution, innovation in the field of telecommunication, emerging technologies in wireless communication and advancement in satellite communication, from which, it is evident there is high demand for Electronics and Communication Engineers around the globe. So, the graduates of this qualification can also find jobs in multinational telecommunication industries like Vodafone, MTN, Reliance, Huawei, Cisco, Verizon, Qualcomm etc.

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PURPOSE:

The purpose of this qualification is listed below as follow

The graduates of this qualification will be able

- Apply the acquired scientific, mathematical and engineering knowledge and come up with innovative solutions to real life problems and challenges that beset the country such as youth unemployment, poverty and inequality.
- Capable of exercising independent engineering judgment and take responsible decisions such as financial, economic, social, and environmental, within the emblem of statutory requirements.
- Analyse and design solutions to issues in Engineering using appropriate Electronics and Communication Engineering technologies, theory, circuits, and techniques as well as associated programming and software applications.
- Provide advanced and in-depth understanding and competence in Electronics and Communication Engineering, as preparation for engagement in masters or other engineering research programmes.

ENTRY REQUIREMENTS (including access and inclusion)

Entry into this qualification is through any one of the following requirements:

- 1) NCQF Level 4, Certificate IV in General Education or TVET.
- 2) Certificate V holders may be granted exemptions based on the relevance of the subjects.
- 3) Applicants that do not meet the above criteria but possess relevant industry experience will be considered through recognition of prior learning (RPL).

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SECTION B QUALIFICATION SPECIFICATION	
GRADUATE PROFILE (LEARNING OUTCOMES)	ASSESSMENT CRITERIA
1. Apply the principles of mathematics, science and engineering in the areas of electronic and communication engineering and related disciplines. 	1.1 Demonstrate the use of knowledge in mathematics, science and engineering. 1.2 Assess mathematical applications of circuits and systems in electronics and Communication Engineering disciplines. 1.3 Communicate concepts, ideas and theories 1.4 Apply theories, principles and laws. 1.5 Handle uncertainty and risks using probability and statistics. 1.6 Apply scientific skills in designing engineering products.
2. Design and conduct experiments with appropriate techniques and tools and critically investigate, analyse and interpret data.	2.1 Evaluate electronic circuits. 2.2 Assess the design in terms of the social, economic, legal, health, safety, and environmental impact and benefits. 2.3 Assess the methodologies used to conduct the experiments. 2.4 Use appropriate laboratory equipment and software tools for designing, testing and analyses. Conduct experiments and critically investigate, analyse and interpret data. 2.5 Interpret the design logic and relevant information in a technical manual.

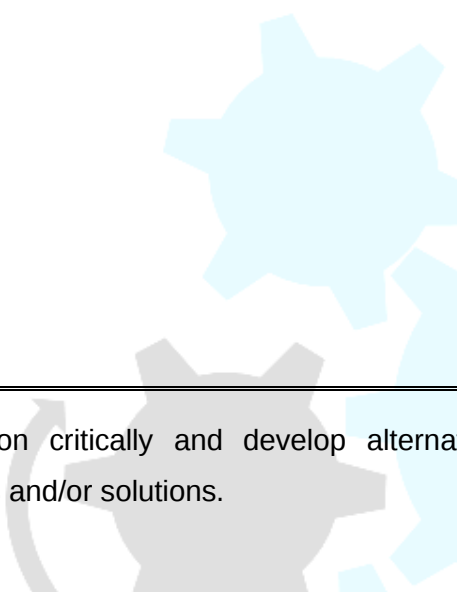
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3. Design a system, component or process per given specifications and requirements in the areas of Electronic Engineering and related disciplines. 	3.1 Gather information about the specifications and requirements for designing a system, component or process. 3.2 Apply procedural and non-procedural design and synthesis steps based on a solution feasibility. 3.3 Design electronic and communication Engineering end products & evaluate them. 3.4 Assess the methodologies used to design an electronic and Communication Engineering end-product. 3.5 Present a complete document summarising the system components or processes. 3.6 Present and test prototypes. Perform formal analysis and modelling on engineering systems, components, and/or processes.
4. Identify solutions to problems and projects by making use of diverse technical knowledge and skills.	4.1 Analyse and define problems. 4.2 Identify and use relevant information, technical knowledge and skills for solving problems. 4.3 Formulate various approaches that would lead to workable solutions. 4.4 Evaluate solutions and select the best solution. 4.5 Demonstrate troubleshooting skills. 4.6 Formulate and present a solution in an appropriate form. Design advanced circuits and systems.
5. Conceptualize and assess constraints that may influence engineering problems, systems and/or projects.	5.1 Identify & differentiate engineering problems. 5.2 Identify relevant solutions to engineering problems. 5.3 Demonstrate the assessed constraints.

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	5.4 Formulate the engineering problem to satisfy user needs. 5.5 Plan and manage the design process to focus on important issues that deal with constraints.
6. Follow development trends in Electronic and Communication engineering and related disciplines.	6.1 Demonstrate the awareness of emerging application software and technologies used in electronics and communication engineering and related disciplines. 6.2 Research on discipline-related development trends. 6.3 Stay abreast with developing literature and trends.
7. Act professionally and ethically and take responsibility for exercising judgment commensurate with knowledge and experience.	7.1 Adhere to engineering code of conduct. 7.2 Demonstrate the ability to take responsibility for consequences stemming from individual actions and/or teamwork. 7.3 Make decisions within engineering or related fields. 7.4 Describe the ethical implications of engineering decisions in terms of trustworthiness, the impact on the environment, business and economy.
8. Communicate effectively via graphic, numeric, verbal and written media with engineering audiences and the community at large.	8.1 Evaluate different communication methods. 8.2 Prepare and present cost estimates, work schedules, instruction manuals and engineering project reports. 8.3 Demonstrate effective communication skills. 8.4 Prepare and interpret Engineering drawings and specifications. 8.5 Ensure correct interpretation of instructions.

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		8.6 Ensure that clear instructions are given to subordinates using appropriate language and communication aids. 8.7 Provide information in a format that can be used by others involved in the engineering activity. 8.8 Oral presentations are made using language, structure, style, visual media and supporting documents appropriate to the audience and purpose.
	9. Reason critically and develop alternative views and/or solutions.	9.1 Develop new designing techniques. 9.2 Demonstrate knowledge on critical thinking and reasoning. 9.3 Able to come up with new engineering solutions.
	10. Work effectively as an individual, in teams and in multidisciplinary environments showing leadership and with professional interpersonal skills.	10.1 Work independently and as a member of a team in various project environments. 10.2 Demonstrate leadership skills. 10.3 Organise and manage projects.
	11. Demonstrate knowledge and understanding of Engineering management principles in society, industry and physical environment and address the issues by analysis and evaluation.	11.1 Demonstrate the Engineering management principles of planning, organising, leading and controlling. 11.2 Explain the impact of engineering management in terms of the benefits and limitations to society, industry, and environment. 11.3 Analyse the engineering activity in terms of the impact on the physical environment. 11.4 Evaluate and address the issues that are due to engineering activities.

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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 Subjects/ Courses/ Modules/Units	Physics-1	15	-	-	-	15
	Physics -2	15	-	-	-	15
	General Chemistry -1	15	-	-	-	15
	General Chemistry -2	15	-	-	-	15
	Precalculus	10	-	-	-	10
	Linear Algebra	-	10	-	-	10
	Engineering Mathematics 1	10	-	-	-	10
	Engineering Mathematics 2	-	10	-	-	10
	Engineering mathematics 3	-	10	-	-	10
	Engineering mathematics 4	-	10	-	-	10
	Academic writing for STEM	-	10	-	-	10
	Computer and its essentials 1	10	-	-	-	10
	Computer and its essentials – II	-	10	-	-	10
	Electrical and Electronics Engineering Workshop	-	10	-	-	10

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CORE COMPONENT <i>Subjects/Courses / Modules/Units</i>	Engineering Drawing	-	10	-	-	10
	Engineering Workshop Practice	-	10	-	-	10
	Procedural Programming in C and Python	-	10	-	-	10
	Electronic Devices and Circuits	-	10	-	-	10
	Electrical circuit Analysis	-	10	-	-	10
	Digital Electronics	-	10	-	-	10
	Electromagnetism & Waves	-	10	-	-	10
	Analogue and Digital Electronics Lab	-	10	-	-	10
	Analogue Electronic Circuit Design	-	10	-	-	10
	Communication Engineering	-	-	10	-	10
	Signals and System Design	-	10	-	-	10
	Data Communication and Network Engineering	-	-	10	-	10
	Digital communication	-	-	10	-	10
	Communication lab	-	-	10	-	10
	Design Group project 1	-	-	10	-	10
	Linear integrated circuits Design	-	-	10	-	10
	Microprocessor & Microcontrollers Design Lab	-	-	10	-	10
	Microprocessor & Microcontrollers	-	-	10	-	10
	Wireless communication and networks	-	-	10	-	10

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	Transmission lines and wave guides	-	-	10	-	10
	Digital signal processing	-	-	10	-	10
	Control System Engineering Design	-	-	10	-	10
	Antenna and wave propagation	-	-	10	-	10
	Research Methods in STEM	-	-	-	10	10
	Embedded system Design	-	-	-	10	10
	Design Group project – 2	-	-	10	-	10
	Millimeter wave Optical Communication systems	-	-	-	10	10
	RF Microelectronics and Microwave engineering	-	-	-	10	10
	Optical and microwave engineering laboratory	-	-	-	10	10
	Research Project 1	-	-	-	10	10
	VLSI design	-	-	-	10	10
	Engineers in Society	-	-	-	10	10
	Entrepreneurship & Innovation	-	-	-	20	20
	Research Project 2	-	-	-	10	10
	Professional Practice	-	-	-	60	60
	Security in communication systems	-	-	10	-	10
	Digital Switching and Transmission	-	-	10	-	10

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ELECTIVE/ OPTIONAL COMPONENT <i>Subjects/Courses / Modules/Units</i>	Electronic Instrumentation and Measurement	-	-	10	-	10
	IoT Enabled Systems	-	-	10	-	10
	Robotics and Automation	-	-	-	10	10
	Bio Medical Engineering	-	-	-	10	10
	Advanced Wireless Communication	-	-	-	10	10
	CMOS Analog IC Design	-	-	-	10	10
	Satellite Communication	-	-	-	10	10
	Opto Electronics and networks	-	-	-	10	10
	MEMS	-	-	-	10	10
	Electromagnetic Interface and Compatibility	-	-	-	10	10

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	Credit Value
Level 5	90
Level 6	170
Level 7	150
Level 8	190
TOTAL CREDITS	600

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Rules of Combination:

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

Bachelor of Engineering in Electronics and Communication Engineering will have 600 credits and take five years to complete in the full-time mode of study.

- The credit combination for this qualification is from 160 fundamental components, 410 core components and the remaining 30 is from elective components.
- The full semester internship module may typically be done after the student has passed at least 360 credits worth of modules.

ASSESSMENT ARRANGEMENTS

This qualification is assessed as follows:

Formative assessment: 40%

Summative assessment: 60%

Assessment Types:

- Practical test
- Class assignments
- Presentations
- Informal class tests
- Formal modular tests

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Summative assessment:

Assessment, focusing on the achievement of the exit-level outcomes, will be done by means of a written or practical examination at the end of every module.

Project: Students will need to do project and submit their project work along with a report for the project modules.,

Professional Practice: All students must undergo a workplace training under a supervisor who monitors students' workplace performance and submits a final evaluation report to the tutor (20%). A tutor assigned to a student visits the intern at the workplace, each time making his/her evaluation (15%). At the end of the professional practice, a student will submit a project report (50%). All the marks from tutor visits, supervisor evaluation and project report evaluation will be captured in a form called 'internship report feedback form'.

Pass requirements:

A learner qualifies for the B.Eng in Electronics and Communication Engineering degree on NCQF level 8 when he/she passes all required individual modules. A student passes a module if he/she obtains a final mark of 50% or more in the module. The final mark is constituted of formative assessments (40%) and the summative assessment (60%). The final mark for the qualification is calculated by averaging the marks obtained in the various modules. The student must successfully complete 600 credits to complete the qualification.

MODERATION ARRANGEMENTS

Moderation of assessments focuses on:

- Ensuring that the assessment is aligned to the module objectives and the learning outcomes.
- Ensuring that the assessment is consistent on all levels within the institution and does not show any bias or academic disregard and that it is immune to all forms of prejudice.
- Ensuring that the level of assessment appropriately matches the students' level of study i.e. the assessments remain viable, relevant and provide an accurate judgement of a student's achievements and level of knowledge.

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d) Maintaining consistency in the marking process.

Pre-assessment Moderation:

This moderation is carried before assessment tasks are given to students. All submitted sets of question papers & marking keys are shared with the moderators. Each assessment pack should be moderated by two Moderators where possible. The question paper moderation report should be filled in for each question paper. Moderator report will be shared with question paper setter so that moderator feedback will be taken into account when finalizing the question paper.

Post-assessment moderation or moderation of marking:

Moderation of completed assessment tasks is categorized as post-assessment moderation. It is carried out after assessment tasks have been marked. The set of answer scripts and marking keys are shared with the moderators. At least 10% of the answer scripts in a module should be moderated during post assessment moderation.

The moderators and assessors are well trained and have registered with BQA. The internal and external moderation will be done in-line with the Moderation policy of the Institution.

RECOGNITION OF PRIOR LEARNING

Candidates may apply the recognition of prior learning whether such learning has been gained through formal study, through workplace learning, or through any other formal or informal means, any candidate applying for recognition of Prior learning (RPL) or credit Accumulation and Transfer (CAT) will be expected to provide evidence of such learning that must be relevant, sufficient, valid, verifiable and authentic. Provision of RPL for award of the qualification will be in line with the National RPL policy.

CREDIT ACCUMULATION AND TRANSFER

A clear framework through which students can accumulate learning credits and transfer such credits toward appropriate qualifications helps to validate and recognize learning gained through formal and informal means, provides flexibility to students, and allows students to progress relatively seamlessly through their lifelong

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learning journey. Credit transfer will be applied in line with National Credit Accumulation and Transfer (CAT) Policy.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Vertical:

Having obtained this qualification, the following possibilities for further study in higher education qualifications exist:

Master's in Engineering on related fields like:

- Embedded systems engineering
- VLSI engineering
- Control and instrumentation engineering
- Electronics engineering
- Applied electronics engineering
- Biomedical instrumentation engineering
- Industrial instrumentation engineering
- Telecommunication engineering
- Robotics Engineering
- Power electronics and drives Engineering

Horizontal:

The graduates of this qualification can also progress by doing similar undergraduate qualification, but in different stream as follows:

- Bachelor of Engineering in Electrical and Instrumentation Engineering
- Bachelor of Engineering in Instrumentation and Control Engineering
- Bachelor of Engineering in Electronics and Telecommunication Engineering
- Bachelor of Engineering in Robotics and Automation Engineering
- Bachelor of Engineering in Artificial Intelligence Engineering
- Bachelor of Engineering (Honours) in Electronics and Communication Engineering
- Post graduate Diploma or Post Graduate Certificate (NCQF 8) in the same cognate field.

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Employment Pathway:

The graduates of this qualification will be competent enough to find employment in both public and private sector of electronics industry, Telecommunication industries, Aviation industries, Control instrumentation manufacturing industry, electromedical field, small scale industry, transport sector and IT sector as.

- Electronics Engineers
- Telecommunication Engineers
- Network Engineers
- Network managers
- Communication Engineers
- Microwave system Engineers
- Control System Engineers
- Instrumentation Engineers
- Industrial Automation Engineers
- Process control Engineers
- Project Managers
- Electronic Equipment assemblers
- Site Engineers
- Quality analyst

QUALIFICATION AWARD AND CERTIFICATION

The learner will be awarded 'Bachelor of Engineering in Electronics and Communication Engineering' after attaining 600 credit value and the candidate should have met all the other requirements. This qualification does not have exit awards. Therefore, if the candidate does not meet the prescribed minimum standards of the qualification will exit with a transcript.

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REGIONAL AND INTERNATIONAL COMPARABILITY

This Qualification was compared with various universities running similar qualifications. The following universities and their qualifications were taken for the comparisons:

- **Local: BIUST (Botswana):** Bachelor of Engineering in Telecommunication Engineering
- **Regional: University of Pretoria, South Africa:** Bachelor of Engineering in Electronics Engineering.
- **International: Anna University, Chennai, India.** Bachelor of Engineering in Electronics and Communication Engineering.

BIUST (Botswana): Bachelor of Engineering in Telecommunication Engineering:

Similarities:

- Both the qualifications have common modules such as Engineering Mathematics 1, Engineering Mathematics 2, Engineering mathematics 3 and Engineering mathematics 4.
- Both universities offer courses in electronics theory, procedural language, analogue and digital electronics, control systems, and communication systems.
- The foundation modules Physics, Chemistry, Mathematics and Computing are included in both the qualifications.
- The fundamental engineering modules such as Engineering workshop practice and Engineering Drawing are provided by both the qualifications.
- This qualification and the one offered at BIUST include an internship module.
- The assessment methods of this qualification are similar to BIUST.

Differences:

- BIUST offers RF and microwave engineering modules as elective module; however, this qualification offers both these modules as core modules.
- This qualification has elective modules in MEMS, Biomedical engineering and robotics and automation, whereas BIUST does not offer these courses.
- This qualification offers modules in transmission lines and waveguide, Microprocessor and microcontroller and Embedded system Design. whereas BIUST does not offer these courses.

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- This qualification offers the laboratory modules such as communication lab, optical and microwave engineering lab, microprocessor and microcontroller Design lab, whereas BIUST does not offer these laboratory modules.
- BIUST is offering 4 elective modules and this qualification offers 3 elective modules.
- BIUST offers computing modules such as, Object oriented programming, Computer system architecture and Data structure and Algorithm. These modules are not offered in this qualification.

University of Pretoria, South Africa: Bachelor of Engineering in Electronics Engineering:

Similarities

- Both universities offer foundation courses such as Physics, Chemistry, Mathematics and Computing.
- Both universities offer courses in electronics theory, procedural language, analogue and digital electronics, control systems, communication systems
- University of Pretoria and this university offers the qualification in full time mode.
- The assessment methods of this qualification are similar to those of University of Pretoria.

Differences:

- The duration of this qualification is five years and the one offered at University of Pretoria is four years.
- University of Pretoria does not offer any elective modules, whereas this qualification offers 3 elective modules.
- This qualification offers Entrepreneurship module; University of Pretoria does not offer this module.
- This qualification offers Engineering Workshop Practice and Engineering drawing modules. University of Pretoria does not offer these modules.

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Anna University, Chennai, India. Bachelor of Engineering in Electronics and Communication Engineering:

Similarities

- Both qualifications offer courses in electronics theory, procedural language, analogue and digital electronics, control systems, Communication systems.
- Both qualifications offer foundation courses such as Physics, Chemistry, Mathematics and Computing.
- Anna University and this university offer the qualification in full time mode.
- The assessment methods of this qualification are similar to those of Anna University.
- Anna University, and this qualification offer the fundamental engineering modules such as Engineering workshop practice and Engineering Drawing.
- This qualification and Anna University offer modules such as Digital signal processing, Signals and systems, antenna and wave propagation, Digital communication, and millimeter wave optical communication.

Differences:

- In Anna university, 1 credit = 15 learning hours, were as in this qualification 1 credit = 10 Learning hours
- This Qualification offers Entrepreneurship module; Anna University does not offer this module.
- Anna University does not offer Professional practice/internship module, whereas this qualification offers this module.

REVIEW PERIOD

5 Years