SECTION A:	***QUALIFICATION DETAILS***																	
QUALIFICATION DEVELOPER (S)	UNIVERSITY OF BOTSWANA																	
TITLE	Bachelor of Engineering Honours (Electronic)													***NCQF LEVEL***			**8**	
FIELD	Manufacturing, Engineering and Technology		***SUB-FIELD***		Engineering and engineering trades									***CREDIT VALUE***			**611**	
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

The Human Resource Development Council has ranked Electronic Engineering among the top occupations and most sought-after skills in Botswana. The programme contributes towards the strategic role of meeting the country's development needs through advancing human resource development and developing research and innovation capacity (Towards a Knowledge Society). (Tertiary Education Policy, 2010; Revised National Policy of Education 1994; Education and Training Sector Strategic Plan, 2015, National Development Plan 11, 2017). Furthermore, this programme is commensurate with three of the pillars *of Vision 2036* of producing 'sustainable economic development, human and social development and sustainable environment', as well as two key future imperatives of 'innovation and sustainability'. The role of the discipline in research and development, innovation, science, and technology, cannot be overemphasized in transforming Botswana into a creative, sustainable, and knowledge-based economy.

The proposed Bachelor of Engineering Honours (Electronic) qualification is designed to contribute to the objectives of National Development Plans through technology and innovation in the specialisation areas of Electronic Engineering. The qualification ensures that the students' education meets the global standards for continuing education for practising engineering professionals, employment opportunities and attainment of higher education in preparation for careers in academia. The qualification is developed in accordance with Engineering Registration Body (ERB) standards and procedures

PURPOSE:

The purpose of this qualification is to produce graduates with knowledge, skills, and competences to:

i) Plan and design electronic devices and electronic systems.

ii) Solve problems in electronic devices and electronic systems.

iii) Use coding and simulation for developing new system models and applications.

iv) Conduct research and develop innovative technology related to electronic engineering.

v) Effectively conduct project management in electronic engineering related fields.

vi) Use effective communication strategies in the domain of electronic engineering.

ENTRY REQUIREMENTS (including access and inclusion)

- The normal minimum entry requirement for admission is NCQF Level 4 or its equivalent.
- Entry through Recognition of Prior Learning (RPL) will be considered in line with national and Institutional policies.

SECTION B QUALIFICATION SPECIFICATION	
GRADUATE PROFILE (LEARNING OUTCOMES)	**ASSESSMENT CRITERIA**
1. Solve complex electronic engineering problems creatively and innovatively using the principles of applied mathematics and basic sciences.	1.1. Analyze the best possible solution for an electronic engineering problem. 1.2. Formulate a suitable design process that will satisfy the solution specifications. 1.3. Plan and manage the design process with full awareness of the limitations thereof. 1.4. Use the appropriate tools to analyze, optimize and verify a design. 1.5. Evaluate the efficacy of the solution in solving a problem. 1.6. Use scientific principles to model electrical and electro-mechanical problems and show how the models can be used to build and/or represent electronic devices and systems.
2. Perform creative, procedural, and non-procedural design synthesis of components, systems, engineering works, products, or processes.	2.1. Analyze engineering design problem(s) and formulate solution requirements. 2.2. Propose possible solutions, analyze suitability and efficacy of those solutions, and choose the best one. 2.3. Formulate a design process that will satisfy certain specifications. 2.4. Manage the design process with full awareness of the limitations thereof.

	2.5. Use the correct tools to optimize and verify the design. 2.6. Report Design information in a logical and clear manner.
3. Conduct investigations and experiments in electronic engineering.	3.1. Establish sound experimental method(s) that allow to measure the variable(s) and test the hypothesis. 3.2. Design scientific electrical engineering experiments. 3.3. Conduct scientific electrical engineering experiments. 3.4. Analyze and interpret data for open ended investigations.
4. Design and analyze electronic circuits, systems and applications using Computer Aided Design (CAD) software/s.	4.1. Use modern engineering techniques, skills, and tools (including computer-based tools) to analyze electronic engineering circuits and systems. 4.2. Apply modern engineering techniques, skills, and tools (including computer-based tools) to design electronic engineering circuits and systems. 4.3. Conduct experiments using computer aided design (CAD) software. 4.4. Utilize industry standard instruments and tools correctly and safely to design and conduct experiments.
5. Communicate effectively with engineering audiences and the community at large.	5.1. Communicate orally (through presentations and demonstrations) to both technical and non-technical audiences on aspects of electronic engineering.

	5.2. Communicate in writing (through term papers, project reports, technical reports, proposals, poster, manuals, etc.), to both technical and non-technical audiences on aspects of electronic engineering. 5.3. Use effective language, style, structure, and graphical representations to inform a target audience.
6. Work effectively as an individual or in a team.	6.1. Carry out electronic engineering projects with minimal supervision 6.2. Integrate and work effectively in a team and multidisciplinary setting. 6.3. Apply electronic engineering principles in other fields as an individual or part of a multidisciplinary team.
7. Use electronic engineering management principles in economic decision-making and assessment of the related risks.	7.1. Employ basic techniques from economics, business management and project management to one's own work. 7.2. Apply collaboration tools, including Internet-based conferencing and graphics sharing to have real-time collaboration results in timely and coordinated manner. 7.3. Validate control measures to manage the risk in an organization.
8. Conduct research independently to solve engineering problems.	8.1. Formulate methodologies to analyze and evaluate proposed engineering solutions. 8.2. Develop hypothesis and define the pertinent variable(s) as necessary.

9. Adhere to high level of engineering ethics and practices.	9.1. Demonstrate awareness of social and ethical implications of applying knowledge in particular contexts. 9.2. Uphold the ethical and the professional conduct requirements of an engineer. 9.3. Uplift and enhance the role of engineering in society through ethical practices. 9.4. Identify issues in engineering practice in the discipline such as health, safety, and environmental protection.

SECTION C			***QUALIFICATION STRUCTURE***			
COMPONENT	***TITLE***		***Credits Per Relevant NCQF Level***			***Total*** ***(Per** Subject/ Course/ Module/ Units)*
			L [6]	**L [7]**	**L [8]**	
FUNDAMENTAL COMPONENT *Subjects/ Courses/ Modules/Units*	Materials Science for Engineers		√			**13**
	Engineering Mechanics: Statics			√		**13**
	Electrical Fundamentals I		√			**13**
	Engineering Mathematics I			√		**12**
	Engineering and Computer Aided Drawing			√		**12**
	Mechanics of Materials			√		**13**
	Electrical Fundamentals II			√		**13**

	Workshop Technology		√		**12**
	Engineering Mathematics II		√		**12**
	Dynamics of Particles		√		**13**
	Electrical Network Theory		√		**13**
	Analogue Electronics Fundamentals			√	**13**
	Electrical Instrumentation and Measurements			√	**13**
	Computer Programming, I			√	**15**
	Engineering Mathematics III			√	**12**
	Digital Electronics			√	**13**
	Electromagnetics for Engineers			√	**13**
	Electrical Engineering Design		√		**15**
	Basic Electrical Machines			√	**13**
	Engineering Mathematics IV			√	**12**

CORE COMPONENT *Subjects/Courses/ Modules/Units*	Industrial Training, I			√	**36**
	Control Systems I			√	**13**
	Signals and Systems			√	**13**
	Analogue Electronics Design			√	**15**
	Communications Principles			√	**13**
	Computer Programming II			√	**13**
	Control Systems II			√	**13**
	Microprocessor Engineering Applications			√	**15**
	Digital Electronics Design			√	**15**
	Electronic Experimental Design Laboratory			√	**15**
	Foundations of Engineering Law			√	**9**
	Engineering Economics	√			**9**
	Industrial Training II			√	**36**

	Electronic Design Project I			√	**16**
	Independent Study Topic			√	**15**
	Environmental Management			√	**9**
	Engineering and Project Management			√	**9**
	Electronic Design Project II			√	**43**
	Professional Ethics and Practice			√	**9**
ELECTIVE/ OPTIONAL COMPONENT *Subjects/Courses/ Modules/Units*	ELECTIVE: Choose one from the following (Each 9 Credits)	√			**9**
	Introduction to Political Science				
	Introduction to Public Administration				
	Introduction to Sociological Concepts and Principles				
	Sociology of Development				
	OPTION 1 (Electronic): Choose one from the following (Each 13 Credits)			√	**13**

	Digital Signal Processing Principles				
	Computer Architecture and Systems				
	Antennas and Wave Propagation				
	Telephony and Digital Communications				
	OPTION 2 (Electronic): Choose one from the following (Each 13 Credits)			√	**13**
	Advanced Digital Signal Processing				
	EEB542 Communication Networks				
	Electromagnetic Wave Guides				
	Wireless Communications				

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	***Credit Value***
Level 6	***44***
Level 7	***130***
Level 8	***437***
TOTAL CREDITS	***611***

Rules of Combination:

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

A student shall take courses of specified credits as shown in the components:

Type of Course	No.	Credits
Fundamental Component	20	**260**
Core Component	19	**316**

Elective Component	3	**35**
Total	42	**611**

(i) Programme shall consist of 611 notional credits from 42 courses, resulting in 611 credits for the BEng Honours (Electronic) qualification.

(ii) The courses shall consist of 20 fundamental courses, 19 core courses and 3 elective courses.

(iii) The elective courses must be selected as per prescribed lists:

(iv) Courses shall be done over 8 semesters (full time).

(v) Industrial Training shall be done after the second semesters of the Level 300 and Level 400 i.e., after the 4th and 6th semesters.

ASSESSMENT ARRANGEMENTS
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. **Summative assessment** The Final Examination contributes to **60%** of the final grade. **Formative assessment** Formative assessments contribute to **40%** of the final grade
MODERATION ARRANGEMENTS
Assessment and moderation shall be carried as per the Universities policies and guidelines, which are aligned to BQA/ National policies. Both internal and external moderation shall be carried out. The department shall engage only BQA accredited assessors and moderators to carry out assessment and moderation.
RECOGNITION OF PRIOR LEARNING
Recognition of Prior Learning (RPL) for the award of this qualification will be in line with the Institutional and National policies.

CREDIT ACCUMULATION AND TRANSFER

Credit Accumulation Transfer (CAT) for the award of this qualification will be in line with the Institutional and National policies.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

LEARNING PATHWAYS

Horizontal Articulation (related qualifications of similar level that graduates may consider)

- BEng/BSc Electrical Engineering
- BEng/BSc Electrical and Electronic Engineering
- BEng/BSc Control Systems Engineering
- BEng/BSc Telecommunications Engineering
- BEng/BSc Computer Engineering
- BEng/BSc Biomedical Engineering
- BEng/BSc Mechatronics

Vertical Articulation (qualifications to which the holder may progress to)

The graduates of the BEng (Electronic) qualification with an appropriate level of achievement, will have the ability to proceed to postgraduate studies in both course-based and research masters programmes, both locally and internationally.

- Post graduate programmes (MSc, MEng, MPhil) in:
  - Electronic Engineering
  - Electrical and Electronic Engineering
  - Telecommunications Engineering
  - Systems Engineering
- Master of Business Administration
- Master's degree in Project Management.
- Research in Electrical and Electronic Engineering.

EMPLOYMENT PATHWAYS

Carrier opportunities for graduates of the BEng (Electronic) qualification include:

- Electronic Engineer
- Lecturer
- Researcher
- Telecommunications Engineer
- Systems Engineer
- Project Engineer
- News analyst/reader
- Meteorological Engineer

QUALIFICATION AWARD AND CERTIFICATION

Bachelor of Engineering Honours (Electronic) qualification is awarded upon:

(i) Attaining the requisite 611 credits,
(ii) Satisfying the programme regulations, and
(iii) Satisfactorily meeting all exit level outcomes

The qualification will meet criterion set by the Washington Accord.

Certification

Upon completion of the above in (i), (ii), and (iii) above, the candidate will be awarded a Bachelor of Engineering Honours (Electronic) in accordance with the applicable institutional policies.

A certificate and transcript will be issued at award.

REGIONAL AND INTERNATIONAL COMPARABILITY

The BEng (Electronic) qualification is designed to be acceptable in the 16 regional and international Washington Accord signatory countries.

A benchmarking exercise was carried out to compare current trends in the field, modes of qualifications offering, qualification structure and content, as well as offer clarity in specializations being offered by regional and international universities as follows:

- Five (5) regional universities which are all in South Africa:
  - University of Pretoria, South Africa: https://www.up.ac.za/programmes/programme/12130008/year/2022 ; https://www.up.ac.za/yearbooks/2021/programmes/view/12130008 ; https://www.universityofpretoria-international.com/programmes/beng-electronic-engineering/?_ga=2.51210734.690936298.1648041970-521142934.1648041970&_sp=ab977896-89d3-491f-b88c-645797e28493.1648042064962
    BEng Electronic Engineering.
  - University of Cape Town, South Africa: http://www.ee.uct.ac.za/bachelor-science-engineering-electrical-engineering
    BSc (Engineering) (Electrical and Computer Engineering).
  - Stellenbosch University, South Africa: http://www.eng.sun.ac.za/undergraduate-programmes/ https://www.sun.ac.za/english/Documents/Yearbooks/Current/Engineering.pdf
    BEng Electrical and Electronic Engineering.
  - University of the Witwatersrand, South Africa: https://www.wits.ac.za/eie/undergraduate-programmes/ https://www.wits.ac.za/media/wits-university/students/academic-matters/documents/2022%20EBE%20Rules%20and%20Syllabuses%20Final.pdf
    BEng (Electronic Engineering).
  - University of KwaZulu-Natal, South Africa: https://b3e5e3j9.stackpathcdn.com/wp-content/uploads/2020/12/2020-SE-brochure-Web.pdf ; https://caes.ukzn.ac.za/wp-content/uploads/2022/01/2022-Handbook.pdf

Bachelor of Science (Electronic Engineering).

- Two (2) universities outside the region which are in the United Kingdom:
  - Staffordshire University, United Kingdom: https://www.staffs.ac.uk/course/electrical-electronic-engineering-beng-meng#contents
    Bachelor of Engineering (Hons) (Electronic and Telecommunications).
  - Glasgow Caledonia University, United Kingdom: https://www.gcu.ac.uk/media/courses/psp/ebe/ug/P02866_P02868_BEngMEng_Electrical_and_Electronic_Engineering_20-21_PSP_Extract.pdf
    BEng (Hons) Electrical and Electronic Engineering.

Benchmarking with Regional Universities

University of Pretoria: BEng (Electronics)

Similarities:

- The duration is four years
- First and second years are common years
- There is a Project in the Final Year.

Differences:

- There is a community-based project in the qualification at the University of Pretoria, while there is none in the proposed qualification.
- There is recess training at year 2 in qualification at the University of Pretoria while the proposed qualification has Industrial Training.
- There is recess training and report in the fourth year of the qualification at the University of Pretoria and Industrial Training at the ends of the second and third years in the proposed qualification.

University of Cape Town: BSc (Engineering) (Electrical and Computer Engineering)

Similarities:

- The duration is four years, although the University of Pretoria allows for doing the qualification in five years,
- First and second years are common.
- There is practical training at third year
- There is a final year project

- There are elective courses in the third and fourth years.

Differences:

- The University of Cape Town has practical training in the first and third years while the Industrial Training in the proposed qualification is in the second and third years.
- There is a provision at the University of Pretoria to opt to do the qualification over five years, subject to satisfying the regulations. The proposed qualification does not have such a provision.

Stellenbosch University: BEng Electrical and Electronic Engineering

Similarities:

- The duration is four years.
- First and second years are common, except that at Stellenbosch University one of the five focus areas, data engineering, has a different qualification in the second semester.
- Students follow different subject areas from the third year.
- There is a project in the final year.

Differences:

- The first year at Stellenbosch University is a common sciences year while the first year of the proposed qualification is a basic engineering year.
- Stellenbosch University has five focus areas in electrical engineering of electromagnetics and Telecommunication, informatics, energy, robotics, and data engineering while the proposed qualification has only one area.

- There are options for students to choose to interrupt their studies and go for industrial training for one year at Stellenbosch University while in the proposed qualification the industrial training is after the second and third years.

University of the Witwatersrand: BEng (Electronic)

Similarities:

- The duration is four years.
- First and second years are common, except that there is one complimentary course in the qualification for the University of Witwatersrand.
- There is Vacation Training in the second year.
- Students follow different subject areas from the third year.
- The qualification in third year is common to the chosen subject area.
- The qualifications

Differences:

- The split to the subject area subjects at the University of the Witwatersrand is made at the third year while in the proposed qualification it is made at the second year.
- There is no Vacation Training in the third year of the qualification at the University of the Witwatersrand while the proposed qualification has Industrial Training at the end of the third year.
- The fourth year has three electives at the University of the Witwatersrand while the proposed qualification has 2 Electives.

University of KwaZulu Natal: BEng(xx)

Similarities:

- Years one and two of study are common years.
- Some courses are from outside the department.
- There is a Design and research project in the final year at University of KwaZulu Natal while the proposed qualification has a Final Year Projects I and Final Year Project II.

Differences:

- Year 3 is common at the University of KwaZulu Natal while Year 3 has an Elective in the proposed qualification.
- Some electives are taken from outside the College at the University of KwaZulu Natal.
- Some elective modules are taken from the Mechanical Engineering qualification at the KwaZulu Natal.
- There is no Industrial Training in the qualification for University of KwaZulu Natal while the proposed qualification has Industrial Training at the ends of the second and third years.

Benchmarking with International Universities

Staffordshire University: BEng (Hons) (Electronic & Telecommunication)

Similarities:

- Second year is common.
- There is a final year project

Differences:

- The duration of the qualification at Staffordshire University is three years while that of the proposed qualification is four years.

- The qualification for Staffordshire University does not have Industrial Training while the proposed qualification has Industrial Training at the end of the second and third years.
- Staffordshire University offers two options on mathematics (for those with or without A-Level mathematics) in the first year while the proposed qualification does not offer such options.
- Staffordshire University has no electives in the third and final years, while the proposed qualification has two electives.

Glasgow Caledonian University: BEng (Hons) Electrical and Electronic Engineering

Similarities:

- The duration is four years.
- Year 1 is common.
- Year 3 has one option and Year 4 has two options.
- There is a final year project

Differences:

- The second year has one option.
- Glasgow Caledonian University has an option of Industrial Practice after third year and the candidate is awarded a sandwich qualification while the proposed qualification has Industrial Training at the end of the second and third years.
- Glasgow Caledonian University gives eligible students an option of a European Exchange Placement After successful completion of Level 3 Trimester 1 in which they undertake an optional study exchange during Trimester 2 at an appropriate host Institution outside the UK, provided the

agreed qualification is equivalent to the curriculum and intended student experience normally undertaken in Level 3 Trimester 2. Successful completion of the study exchange is credit bearing to 60 credits. The proposed qualification does not have such an option.

- Glasgow Caledonian University has no electives in the third and final years, while the proposed qualification has two electives.

Overview of the Similarities and Differences

Similarities

- All the benchmarked programmes and the proposed qualification have fundamental, core and electives subjects/courses and they are fashioned against a National Qualification Standard.
- The benchmarked programmes and the proposed qualification all in general have design/projects and laboratory subjects which require submission of reports for examination. In addition, they have industrial attachments that expose the students to industry.

Differences

- It is observed is that the entry into electronics engineering in some of the benchmarked universities is in some cases after A levels and the duration is reduced to three years. The entry into the proposed qualification is NCQF Level 4.
- The duration of the proposed qualification is 4 years (after a university level sciences year), those in South Africa are four years and of two in the UK one has a duration of four years and the other one a duration of 3 years.

Another difference is that the learning outcomes specified for IET accredited qualifications have been developed to provide for variety and flexibility in the design of qualifications and encourage innovation while maintaining a core understanding of engineering principles.

Summary:

The proposed BEng Honours (Electronic) qualification is very similar to the qualifications of the South African universities – they are all at Level 8.

The contents of the benchmarked regional and international qualifications and those of the proposed qualification are similar.
REVIEW PERIOD
▪ Every five (5) years