

	BQA NCQF QUALIFICATION TEMPLATE	Document No.	DNCQF.QIDD.GD02
		Issue No.	01
		Effective Date	04/02/2020

SECTION A: QUALIFICATION DETAILS													
QUALIFICATION DEVELOPER (S)		BOTHO UNIVERSITY											
TITLE	Bachelor of Engineering in Electrical Engineering										NCQF LEVEL	8	
FIELD	Manufacturing, Engineering and Technology			SUB-FIELD		Electrical 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 electricity plays a vital role. Due to increasing number of industries, mines, development in the infrastructure and rural electrification, the demand for electricity has increased abundantly in recent times. To fulfill the demand for electricity, a new power plant was constructed in Morupule. The Botswana government is also promoting the usage of renewable energy in generation of electricity and is planning to install a number of solar energy power plants in the country (https://www.export.gov/article?id=Botswana-Energy), hence the need for more electrical engineers. This qualification will therefore ensure a steady supply of electrical engineering graduates equipped with the knowledge and skills to work as managers and supervisors in power plant stations, various power grids, industries, and mines.													

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Botswana seeks among other development imperatives to be 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 Electrical engineers.

The Human Resources Development Council (HRDC) *Priority skills (Current and Future)* document articulates the need for human resources in engineering. The occupations related to the Bachelor of Engineering in Electrical Engineering qualification which are mentioned in the HRDC document are Electrical and Electronic Equipment Assemblers, Control and Instrumentation Engineers, Industrial Automation Engineers and Technicians, Industrial Engineers, Manufacturing Engineers, project Managers, Instrumentation technicians, Solar System Technicians, Process control technicians, Energy Managers and Electrical Technicians. Electrical Engineering graduates are equipped to work in the above-mentioned occupations.

A detailed market survey was conducted to establish the need to offer BEng in Electrical Engineering and to determine the viability of the qualification in line with industrial and business trends. The responses from the survey were positive with an inkling that Electrical Engineering is indeed needed and is sustainable.

There is also a high demand for Electrical engineers around the globe, due to industrialization, electrification, and innovation in the field of Electrical Engineering.

PURPOSE:

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

- Apply scientific, mathematical, and engineering knowledge to come up with innovative solutions to unpredictable and complex real-life problems and challenges that beset the country.
- exercise independent engineering judgment and take responsible decisions such as financial, economic, social, and environmental and within the emblem of statutory requirements.
- operate in an electrical engineering design and project-based platform.

The qualified engineer will be able to register with the Engineering Registration Board (ERB) as a Professional Engineer in the field of Electrical Engineering.

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ENTRY REQUIREMENTS (including access and inclusion)

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

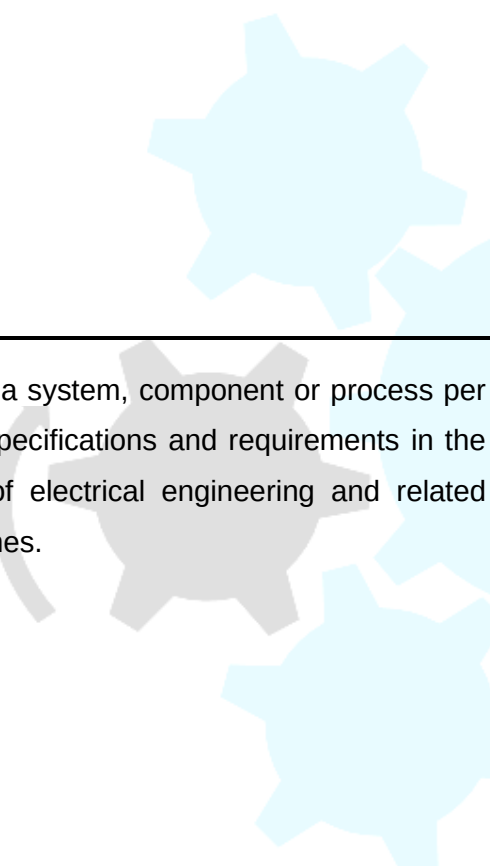
- 1) NCQF Level 4 (e.g. Botswana General Certificate of Secondary Education (BGCSE)) or equivalent with a minimum of a pass in five subjects including English, Mathematics, and Physics / Double sciences / Physics & Chemistry.
- 2) Applicants that do not meet the above criteria but possess relevant industry experience will be considered through recognition of prior learning (RPL).

SECTION B

QUALIFICATION SPECIFICATION

GRADUATE PROFILE (LEARNING OUTCOMES)	ASSESSMENT CRITERIA
1. Apply the principles of mathematics, science, and engineering in the areas of electrical 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 electrical engineering disciplines. 1.3 Communicate concepts, ideas, and theories 1.4 Apply theories, principles, and laws. 1.5 Handle uncertainty and risks through the use of 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 electrical and electronic circuits. 2.2 Assess the design in terms of the social, economic, legal, health, safety, and environmental impact and benefits.

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		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.
	3. Design a system, component or process per given specifications and requirements in the areas of electrical 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 electrical end products & evaluate them. 3.4 Assess the methodologies used to design an electrical 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.

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	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. 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 electrical engineering and related disciplines.	6.1 Demonstrate the awareness of emerging application software and technologies used in electrical 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	8.1 Evaluate different communication methods.

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engineering audiences and the community at large. 	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 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. 10.4 Mentor and train team members. 10.5 Build and maintain relationships, respect, and trust with team member. Recognise and discharge responsibilities within team members.

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	10.6 Ensure that different social and cultural values are taken into account when dealing with colleagues, clients and stakeholders. 10.7 Effective documentation team contributions emanating from discussions and meetings 10.8 Demonstrate effective communication with team members.
11. Apply, in a self-critical manner, learning strategies which effectively address his or her professional and ongoing learning needs and that of others.	11.1 Determine own learning requirements and strategies to suit personal learning style and preferences 11.2 Manage learning tasks autonomously and ethically in learning groups. 11.3 Source, organise and evaluate relevant information. 11.4 Knowledge acquired is understood and applied. 11.5 Reflect on own learning and determine learning requirements and strategies.

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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 <i>Subjects/ Courses/ Modules/Units</i>	Physics-1	15	-	-	-	15
	Physics -2	15	-	-	-	15
	General Chemistry -1	15	-	-	-	15
	General Chemistry -2	15	-	-	-	15
	Computer and its essentials 1	10	-	-	-	10
	Computer and its essentials 2	-	10	-	-	10
	Linear Algebra	-	10	-	-	10
	Pre-calculus Mathematics	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
	Principles of Electrical Engineering	-	10	-	-	10
CORE COMPONENT <i>Subjects/Courses / Modules/Units</i>	Engineering Workshop Practice	-	10	-	-	10
	Engineering Drawing	-	10	-	-	10
	Procedural Programming in C and Python	-	10	-	-	10

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	Signals and System Design	-	10	-	-	10
	Electrical Circuit Analysis	-	10	-	-	10
	Electromagnetism & Waves	-	10	-	-	10
	Sustainable Energy Systems	-	-	10	-	10
	Power Transmission and Distribution	-	-	10	-	10
	Applied mechanics and thermofluids	-	-	10	-	10
	Electronic Circuits	-	10	-	-	10
	Year 2 design make project	-	10	-	-	10
	Analogue Electronic Circuits Design	-	10	-	-	10
	Digital Electronics	-	10	-	-	10
	Analog and Digital Electronics Lab	-	10	-	-	10
	Microprocessor & Microcontrollers	-	-	10	-	10
	Microprocessor & Microcontroller Design Lab	-	-	10	-	10
	Digital Signal Processing	-	-	10	-	10
	Control System Design	-	-	10	-	10
	Control System Design Laboratory	-	-	10	-	10
	Year 3 design make project	-	-	10	-	10
	Instrumentation and PLC programming	-	-	10	-	10
	Research Methods in STEM	-	-	-	10	10
	Electrical Power Systems Design	-	-	-	10	10
	Power Systems Design Lab	-	-	-	10	10

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	Electrical Machines and Drives	-	-	-	10	10
	Electrical Machinery Lab	-	-	-	10	10
	Electrical Engineering Design	-	-	10	-	10
	Power System Analysis	-	-	10	-	10
	Engineers in Society	-	-	-	10	10
	Entrepreneurship and Innovation	-	-	-	10	10
	Power Electronics and Drives	-	-	-	10	10
	Research Project 1	-	-	-	10	10
	Embedded System Design	-	-	-	10	10
	High Voltage Engineering	-	-	10	-	10
	Modern Energy Conversion	-	-	-	10	10
	Research Project 2	-	-	-	10	10
	Professional Practice	-	-	-	60	60
ELECTIVE/ OPTIONAL COMPONENT <i>Subjects/Courses / Modules/Units</i>	Measurement Systems	-	-	10	-	10
	Protection and Switchgear	-	-	10	-	10
	Medical Instrumentation	-	-	10	-	10
	Power Electronics for Renewable Energy Systems	-	-	10	-	10
	CAD design of Electrical services	-	-	10	-	10
	Engineering Economics	-	-	10	-	10

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SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	Credit Value
Level 5	90
Level 6	180
Level 7	150
Level 8	180
TOTAL CREDITS	600
Rules of Combination: (Please Indicate combinations for the different constituent components of the qualification)	
Bachelor of Engineering in Electrical Engineering will have 600 credits and take five years to complete under the normal full-time mode of study. - The credit combination for this qualification is from 160 fundamental components, 420 core components and the remaining 20 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%

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Assessment Types:

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

Summative assessment:

Assessment, focusing on the achievement of the exit-level outcomes, will be done by means of a written or practical examination (of at least 2 - 3 hours) 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 using a weekly logbook and submits a final evaluation report to the tutor (20%). A tutor assigned to a student visits the intern twice at 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, namely 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 BEng in Electrical 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.

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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.
- 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.

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

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Learning Pathway:

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

- Bachelor's Degree Honours in Electrical Engineering
- Post-Graduate Diploma in Electrical Engineering
- Post-Graduate Certificate in Electrical Engineering
- Masters in Electrical Engineering

OR similar fields like Power electronics and drives Engineering/ Power systems engineering/ Embedded systems engineering/ VLSI engineering / Control and instrumentation engineering/ Electronics engineering/ Applied electronics engineering/ Biomedical instrumentation engineering/ Industrial instrumentation engineering/ Telecommunication engineering.

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Employment Pathway:

Graduates of this qualification will be competent enough to find employment in both public and private sector of heavy machine manufacturing industry, small scale industry, Power plant and Power grids, control instrumentation manufacturing industry, electromedical field, transport industry, information technology (IT) sector and electrical industry.as:

- Control System Engineers
- Electrical Engineers
- Power system Engineers
- Instrumentation Engineers
- Industrial Automation Engineers
- Process control Engineers
- Project Managers
- Power Generation Engineers
- Power distribution Engineers
- Electrical Equipment assemblers
- Site Engineers
- Directors
- Quality analyst

QUALIFICATION AWARD AND CERTIFICATION

The learner will be awarded 'Bachelor of Engineering in Electrical Engineering' after attaining a minimum 600 credits as specified in the rules of combination and credit distribution. If the candidate does not meet the prescribed credit value of the qualification, then the student will exit with a transcript.

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REGIONAL AND INTERNATIONAL COMPARABILITY

This qualification was benchmarked with similar ones from the following universities:

- **Regional: University of Pretoria, South Africa:** Bachelor of Engineering in Electrical Engineering.
- **International: Anna University, India:** Bachelor of Engineering in Electrical and Electronics Engineering.

Similarities

- All the three universities offer courses in electronics theory, procedural language, electrical machines, control systems, electrical power systems,
- The University of Pretoria, Electrical Engineering qualification and this electrical engineering qualification are unique and have the core components required in the Electrical engineering field.
- The curriculum similarity includes subjects such as electronic devices and circuits, Digital electronics, Control Systems etc.
- All the three universities offer the qualification in full time mode.
- The assessment methods of this qualification are similar to those of University of Pretoria and Anna University.
- Anna University and this qualification offer the fundamental engineering modules like Engineering workshop practice and Engineering Graphics.
- Anna university and this qualification offer practical courses like, Analog Electronic Circuit design, Digital electronics, electronic devices and circuits, Microprocessor and microcontroller, Control systems, Power electronics and Electrical machines and drives

Differences:

- Anna University does not offer Professional practice module, whereas this qualification offers Professional practice module.

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- Anna University offers 9 elective modules and University of Pretoria does not offer any elective modules, whereas this qualification offers 2 elective modules.
- In Anna university, 1 credit = 15 learning hours, where as in this qualification 1 credit = 10 Learning hours
- This Qualification offers Entrepreneurship module; Anna University and University of Pretoria do not offer this module.
- This qualification offers Engineering Workshop Practice and Engineering drawing modules. University of Pretoria does not offer these modules.

REVIEW PERIOD

5 Years