SECTION A:	***QUALIFICATION DETAILS***																	
QUALIFICATION DEVELOPER (S)	University of Botswana																	
TITLE	Bachelor of Engineering (Honours) in Civil Engineering														***NCQF LEVEL***	*8*		
FIELD	Manufacturing, Design, Engineering and Technology		***SUB-FIELD***	Civil Engineering											***CREDIT VALUE***	*625*		
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*						

1.0 RATIONALE AND PURPOSE OF THE QUALIFICATION

1.1 RATIONALE:

The qualification has been designed to address the social, economic, and infrastructural needs of Botswana and that of the Sub-African region in the areas of quality engineering, design, technology, and the built environment. It is also in alignment with the vision, mission, values, and strategic plan to contribute to the objectives of National Development Plans through sustainable infrastructure development in the areas of Water Resources and

Environmental Engineering, Transportation and Highway, Structures, Innovative Materials and Construction Engineering.

The qualification is developed to meet the needs of Mining, Mineral and Energy, both conventional and renewable. The Human Resource Development Council (HRDC) report of 2016 has ranked civil engineering among the top occupations and most sought-after skills in Botswana (HRDC, 2016). The roles of the discipline in research and development, innovation, science and technology, and development and maintenance of infrastructure systems cannot be overemphasized in transforming Botswana a creative, sustainable, and knowledge-based economy.

The qualification's core mandate is to produce creative, competent, and motivated professional graduates who are capable of independent critical and innovative thinking for the development of the built environment through research, construction, and entrepreneurship.

The Bachelor of Engineering (Honours) in Civil Engineering qualification has been developed in line with outcome-based learning principles to meet the accreditation requirements and standards of the Engineering Council of South Africa (ECSA) in accordance with the Washington Accord.

The qualification ensures that the students' education meets the global standards for professional engineering practice, registration or licensing, graduate studies, and employment opportunities. The qualification 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 qualification 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.

1.2 PURPOSE:

The purpose of this qualification is, therefore, to build the necessary specialized Knowledge, skills, and competences to:

- Apply appropriate and advanced scientific and engineering methods and techniques to analyze and design structures.

- Conduct detailed engineering analysis and design of structures.
- Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- Develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions.

2.0 ENTRY REQUIREMENTS (including access and inclusion)

Minimum Entry Requirements

- Bachelor's Degree (NCQF level 7) in the same or a cognate field of study.

- Applicants who do not meet the above criteria but possess relevant industry experience may be considered through Recognition of Prior Learning (RPL) and Credit Accumulation and Transfer (CAT) institutional policies in line with National RPL and CAT Policies for access.

SECTION B	***QUALIFICATION SPECIFICATION***
GRADUATE PROFILE (LEARNING OUTCOMES)	***ASSESSMENT CRITERIA***
LO 1. Demonstrate specialized investigative knowledge and carry out experiments and data analysis.	1.1. Identify, formulate, analyse, and solve complex engineering problems creatively and innovatively. 1.2. Provide solutions to problems and challenges in different fields of civil engineering. 1.3. Improve conventional methods and techniques in engineering design, advanced materials, and construction for the realization of sustainable development goals. 1.4. Determine creative, problem solving and critical thinking skills when solving social, economic, and engineering design challenges/tasks. 1.5. Analyse and address complex or abstract problems drawing systematically on the body of knowledge and methods appropriate to design practice.
LO 2. Apply appropriate and specialised scientific and engineering methods and techniques to analyse and design structures .	2.1. Utilize the principles of physical sciences and mathematics as a foundation for engineering solutions. 2.2. Employ knowledge of mathematics, natural sciences, engineering fundamentals and an engineering speciality to solve complex engineering problems. 2.3. Engage analytical skills in different fields of engineering applications.

LO 3. Conduct detailed engineering analysis and design of structures.	3.1. Perform creative, procedural, and non-procedural design and synthesis of components, systems, engineering works, products, or processes. 3.2. Produce implementable models or engineering details with the aids of design aids and codes of practice.
LO 4. Demonstrate specialised knowledge and carry out experiments and data analysis design methods and techniques relevant to industrial design and technology.	4.1. Design and conduct investigations and experiments. 4.2. Conduct feasibility studies for infrastructural development. 4.3. Provide interpretable and easy to implement suggestions, recommendations, and contributions to body of knowledge. 4.4. Conduct in-depth analysis of the economic, social, and environmental factors of the solutions they propose. 4.5. Review information gathering, synthesis of data, evaluation, and management processes in specialised contexts to develop creative responses to problems and issues.
LO 5. Apply specialised engineering methods, skills, and tools, including information technology	5.1. Practice appropriate engineering methods, skills, and tools, including those based on information technology. 5.2. Exhibit advances in modern information and communication technology tools, mathematical and engineering analytical, design and drafting software.

LO 6. Promote and adhere to professional and technical communication and works ethics	6.1. Communicate effectively, both orally and in writing, with engineering audiences and the community at large. 6.2. Present and communicate academic, professional ideas, visually and textually to a range of audiences, offering creative insights, rigorous interpretations and solutions to problems and issues appropriate to the context. 6.3. Exhibit effective verbally communication skills when dealing with clients. 6.4. Illustrate sound sketching, drawing and computer-aided manufacturing skills in designing products, services, and systems.
LO 7. Apply specialised engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	7.1. Establish critical awareness of the sustainability and impact of engineering activity on the social, industrial, and physical environment. 7.2. Exhibit accurate understanding of environmental issues and contributions to the national development plans and the sustainable development goals.
LO 8. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	8.1. Work effectively as an individual, in teams and in multidisciplinary environments. 8.2. Develop an ability to work in a collaborative teamwork structure when conducting research, feasibility studies and implementing design projects.

	8.3. Inspire multidisciplinary and inter-disciplinary collaboration among experts of different specialties.
LO 9. Apply specialised knowledge as needed, using appropriate learning strategies.	9.1. Engage in independent learning through well-developed learning skills.
LO 10. Conduct oneself in line with engineering professionalism and ethics	10.1. Act professionally and ethically and to exercise judgment and take responsibility within own limits of competence. 10.2. Exhibit ethical considerations during feasibility assessments, analytical studies, design infrastructure systems and development of sustainable engineering and construction materials. 10.3. Inculcate professional ethics such as originality, creativity and honesty while performing assignments, tests, experiments, examinations and independent design and research. 10.4. Show an ability to take full responsibility for their work, decision-making and use of resources, and full accountability for their decisions and actions of others where appropriate.
LO 11. Employ requisite specialised engineering management skills to manage variable engineering projects.	11.1. Determine knowledge of engineering management principles and economic decision-making. 11.2. Show entrepreneurial skills for self-reliance and job creation instead of waiting for white-collar jobs

SECTION C		***QUALIFICATION STRUCTURE***				
FUNDAMENTAL COMPONENT *Subjects/Courses/ Modules/Units*	***TITLE***	***Credits Per relevant NCQF Level***				***Total (Per** Subject / Course / Module / Units)*
		L [5]	***L [6]***	***L[7]***	***L [8]***	
	Materials Science for Engineers			***18***		***18***
	Engineering Mechanics: Statics	***18***				***18***
	Electrical Fundamentals I	***18***				***18***
	Engineering Mathematics I	***16***				***16***
	Engineering and Computer Aided Drawing	***12***				***12***
	Mechanics of Materials	***18***				***18***
	Electrical Fundamentals II		***18***			***18***

	Workshop Technology			***14***		***14***
	Engineering Mathematics II		***12***			***12***
	Dynamics of Particles			***18***		***18***
CORE COMPONENT *Subjects/Courses/ Modules/Units*	Surveying		***14***			***14***
	Analysis of Structures			***16***		***16***
	Materials in Construction		***12***			***12***
	Fluid Mechanics for Civil Engineers		***14***			***14***
	Engineering Mathematics III		***16***			***16***
	Geology for Civil Engineers		***12***			***12***
	Reinforced Concrete Design			***14***		***14***
	Soil Mechanics		***14***			***14***
	Hydraulics		***14***			***14***
	Foundation of Engineering Law		***9***			***9***
	Engineering Mathematics IV			***16***		***16***
	Structural Steel Design				***14***	***14***
	Geotechnical Engineering I			***14***		***14***

	Engineering Hydrology			***12***		***12***
	Highway Engineering			***14***		***14***
	Engineering Surveying			***14***		***14***
	Principles of Civil Engineering Construction			***12***		***12***
	Geotechnical Engineering II				***14***	***14***
	Water Supply Engineering				***14***	***14***
	Traffic Engineering				***14***	***14***
	Wastewater Engineering and Management				***14***	***14***
	Environmental Management				***12***	***12***
	Engineering and Project Management				***12***	***12***
	Research Project				***30***	*30*
	Design Project				***30***	***30***
	Measurement and Specifications for Civil Engineers				***12***	***12***

	Professional Ethics and Practice				***9***	***9***
OPTIONAL COMPONENT *Subjects/Courses/ Modules/Units* ***Choose 2 Modules from the Options***	Transportation Engineering				***14***	***28***
	Pre-stressed Concrete Design				***14***	
	Foundations on Difficult Soils				***14***	
	Masonry and Timber Design				***14***	
	Dam Design				***14***	
	Industrial Attachment I			***26***		***26***
	Industrial Attachment II		***26***			***26***
ELECTIVE COMPONENT *Subjects/Courses/ Modules/Units* ***Choose 1 Modules from the Electives***	Introduction to Political Science		***9***			***9***
	Introduction to Public Administration		***9***			
	Introduction to Sociological Concepts and Principles		***9***			
	Sociology of Development		***9***			
		82	***170***	***170***	***203***	***625***

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	***Credit Value***
Level 5	***82***
Level 6	***170***
Level 7	***170***
Level 8	***203***
TOTAL CREDITS	***625***

Rules of Combination:

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

The Bachelor of Engineering (Civil Engineering) degree is composed of major components of Civil Engineering - Structural, Materials and Construction Engineering, Geotechnics and Soil Mechanics, Water Resources and Environmental Engineering, Highway, Traffic and Transportation Engineering and Engineering Management. To attain this qualification, students should fulfil the requisite learning outcomes in fundamental, core, options and elective components.

Fundamental components (536/625)

Civil engineering - 476 credits

Research projects - 60 credits

Optional component (80/625)

Civil engineering - 28 credits

Industrial Attachment - 52 credits

Elective components - **9/625** credits

Total - 625 Credits

ASSESSMENT ARRANGEMENTS

Formative assessment

The qualification shall entail two key assessments which are in nature to support learning and teaching, these are formative and summative assessments. The formative assessment shall ordinarily carry more weight than the summative assessment. Assessments shall be carried out by assessors registered and accredited by BQA.

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

MODERATION ARRANGEMENTS

- All assessments shall be subjected to both internal and external moderation processes
- All moderations exercises shall be undertaken in accordance with both institutional, national, and professional policies
- All moderation exercises shall be undertaken by BQA accredited moderators
- The qualification will also be assessed by the Engineering Council of South Africa (ECSA), who will send External Examiners and Moderators every five years to ascertain whether the programme satisfies the ECSA accreditation standards. The requirements of IED are also aligned to BQA requirements.

RECOGNITION OF PRIOR LEARNING

- There shall be provision for Recognition of Prior Learning (RPL) and Credit Accumulation Transfer (CAT) for the award of this qualification.
- This shall be done in line with the institutional policy and National RPL policy.

CREDIT ACCUMULATION AND TRANSFER

Credit Accumulation Transfer shall also be considered for award of this qualification

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

LEARNING PATHWAYS

Horizontal Articulation:

- Bachelor of Engineering (Honours) Civil and Environmental Engineering
- Bachelor of Engineering (Honours) Civil and Structural Engineering
- Bachelor of Engineering (Honours) Civil and Architecture Engineering
- Bachelor of Science (Honours) Civil Engineering
- Bachelor of Science (Honours) Civil and Environmental Engineering

Vertical Articulation:

- Master of Engineering in Civil Engineering
- Master of Engineering in Civil and Environmental Engineering
- Master of Engineering in Structural Engineering
- Master of Engineering Water Resources and Environmental Engineering
- Master of Engineering in Civil and Architecture Engineering
- Master of Engineering in Civil and Structural Engineering
- Master of Engineering in Urban and Civil Engineering
- Master of Science in Civil Engineering
- Master of Science in Civil and Environmental Engineering

Employment Pathways:

In general, Graduates will have the requisite competencies and attributes to work as:

- Town and Regional planners
- Infrastructure designers

- Project managers
- Maintenance managers/engineers
- Institutional advisers
- Researchers
- Lecturers in Engineering

QUALIFICATION AWARD AND CERTIFICATION

Qualification Award:

To be awarded a Bachelor of Engineering (Honours) in Civil Engineering Degree a candidate is required to have accumulated a minimum of 659 credits and met the following requirements to be awarded a Bachelor of Engineering degree (Civil):

Certification:

Upon successful completion of the qualification and attainment of the qualification, a candidate will be issued with a **Bachelor of Engineering (Honours) in Civil Engineering** and an official transcript.

REGIONAL AND INTERNATIONAL COMPARABILITY

Regionally, the Bachelor of Engineering (Honours) degree in Civil Engineering is offered in many of the countries of Southern Africa at undergraduate and postgraduate levels. The BEng (Honours) in Civil Engineering qualification of the University of Botswana has been reviewed and approved in line with the requirements and standards for the accreditation by the Engineering Council of South Africa in accordance with the Washington Accord.

Summary of Similarities and Differences Observed

Synopsis

The University of Johannesburg (South Africa) offers a three-year Bachelor of Engineering Technology (Civil Engineering) degree designed to build the necessary knowledge, understanding, abilities and skills required

for further learning towards becoming a competent practicing engineering technologist. This qualification completed provides:

1. Adequate preparation for careers in the engineering profession, 2. An educational base required for registration as a Professional Engineering Technologist with ECSA. 3. Entry to NQF level 8 qualification e.g. BEngTech (Honours) and Postgraduate Diplomas. Subsequently, this will pave the way for the graduate to enroll for Masters qualification. 4. The BEngTech is the entry-level qualification for candidacy, i.e. Engineering Technologist (in this regard, the BEngTech replaces the BTech).

All fields of study of the BEng four-year degree offered by the University of Pretoria have been accredited by the Engineering Council of South Africa (ECSA) and comply with the academic requirements for registration as a professional engineer. The qualifications are designed in accordance with the outcomes-based model as required by the South African Qualifications Authority (SAQA). The learning outcomes and contents of the qualifications have been compiled in accordance with the latest accreditation standards (PE-60 and PE-61) of ECSA, which also comply with the SAQA requirements.

Florida Atlantic University offers the Bachelor of Science in Civil Engineering degree which requires128 credits. For credit toward the degree, a grade of "C" or better must be received in each course listed. In addition, all prerequisites for each mathematics, science or engineering course must be completed with a grade of "C" or better before enrolment is permitted.

Similarities

All the 3 institutions have similar knowledge areas and similar exit level outcomes

They have similar employability pathways and

Have similar assessment methods

Differences

Presentation of the information

Qualifications frameworks differ. A UK FHEQ Level 6 is comparable to a SA NQF Level 8. SA degrees are NQF Level 8

It was observed that the Bachelor of Engineering (Honours) in Civil Engineering is comparable to a large extent and articulation horizontally with the Bachelor of Engineering: Civil Engineering and Bachelor of Engineering.

REVIEW PERIOD

Every five (5) years.