SECTION A							
QUALIFICATION DEVELOPER	**GABORONE UNIVERSITY COLLEGE OF LAW AND PROFESSIONAL STUDIES**						
TITLE	**BACHELOR OF CIVIL ENGINEERING TECHNOLOGY IN CONSTRUCTION**				**NCQF LEVEL**	**7**	
FIELD	**Manufacturing, Engineering and Technology**		**SUB-FIELD**		**Building Construction**		
New qualification	✓		**Review of existing qualification**				
SUB-FRAMEWORK	General Education		TVET		Higher Education	✓	
QUALIFICATION TYPE	Certificate		Diploma		Bachelor	✓	
	Bachelor Honours		Master		Doctor		
CREDIT VALUE					**480**		

RATIONALE AND PURPOSE OF THE QUALIFICATION

Rationale

Construction Engineers and technologists team-up together to plan, design, construct and maintain road and rail transportation systems, port and airport facilities, bridges, tunnels, dams, and buildings of all types; water, gas and oil pipelines; energy-generating facilities, water, air and waste treatment plants. Construction Engineering as a professional discipline deal with all these areas. The qualification proposed here therefore aims at producing generalists (Engineers/Technologists) who have a solid grounding in the basic sciences and a wide-ranging view of construction engineering and its applications in developing and improving contemporary societies and it seeks alternative solutions that respect the built environment. The qualification brings together the technological problem-solving ability of engineering and the organisational, administrative, and planning abilities of management in order to oversee the operational performance of complex construction engineering projects.

Human Resource Development Council (HRDC) is the main authority in Botswana for determining priority skills needed by the economy for now and for the future. They do this in close collaboration with respective industries, both public and private sector, and there is no better authority than this to guide qualifications and programmes

development to address needs of the economy. In their (HRDC) December 2016 document titled “Top Occupations in High Demand” and their subsequent March 2019 document titled “Priority Skills (Current and Future)” it is clear that construction related skill are in high demand and will continue to be required for the foreseeable future, or at least up to the year 2028. Some of the identified top occupations in demand include Engineering Professionals with specific skills areas under construction covering Bricklaying, Plastering, Shutter/form worker, Carpentry, Plumbing, etc, all of which are critical components of the proposed qualification (Bachelor of Technology in Construction Engineering.

The proposed qualification possesses the professional, interpersonal and personal management skills necessary for a career in construction engineering and construction management. The qualification develops the graduates to have awareness of their civic responsibilities and their role in sustaining and preserving the environment, as well as managing natural resources. The qualification is intended to train highly skilled personnel, knowledgeable in the management and control of the construction processes, and optimum aggregation of construction resources including finances, human resource, materials, machinery, and methods of work.

A BTech in Civil Engineering in Construction qualification is not only knowledge based but presents hands on and experiential learning. The qualification will provide students with a sound knowledge base in a particular field or discipline and the ability to apply their knowledge and skills to career or professional contexts.

Purpose

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

- Design and conduct experiments with appropriate techniques and tools and critically investigate, analyse, and interpret data.
- Design a system, component or process per given specifications and requirements in the areas of Construction Engineering and related disciplines.
- Identify solutions to problems and projects by making use of diverse technical knowledge and skills acquired.
- Conceptualize and assess constraints that may influence Engineering problems, systems and/or projects.
- Follow development trends in Construction Engineering and related disciplines.
- Act professionally and ethically and take responsibility for exercising judgment commensurate with knowledge and experience.
- Communicate effectively via graphic, numeric, verbal and written media with engineering audiences and the community at large.

- Reason critically and develop alternative views and/or solutions.
- Work effectively as an individual, in teams and in multidisciplinary environments showing leadership and with professional interpersonal skills.
- Demonstrate knowledge and understanding of engineering management principles in society, industry and physical environment and address the issues by analysis and evaluation.

ENTRY REQUIREMENTS (including access and inclusion)

- The minimum entry requirement is NCQF Level 4 (Certificate IV).
- Recognition of Prior Learning (RPL) and/or Credit Accumulation Transfer (CAT) will be considered for access and inclusion.

QUALIFICATION SPECIFICATION	
LEARNING OUTCOMES	**ASSESSMENT CRITERIA**
1. Apply specialised mathematical principles and concepts in planning, executing and managing construction projects.	1.1 Apply verbal quantitative situations algebraically and evaluate these expressions for given replacement values of the variables. 1.2 Apply the square roots and cube roots of whole numbers and the square root of a monomial algebraic expression in simplest radical form. 1.3 Solve multistep linear inequalities in two variables. 1.4 Apply mathematical solutions to construction engineering problems. 1.5 Investigate and analyse function (linear and quadratic) families and their characteristics both algebraically and graphically. 1.6 Solve functions trigonometrically by applying sectors, Pythagorean, double angle identities, circular functions, and sinusoidal curves. 1.7 Deduce application of a variety of series including Power and Taylor series. 1.8 Apply complex numbers into product, summation and special products. 1.9 Draw up different techniques of categorizing numbers. 1.10 Apply basic introductory calculus.

2. Demonstrate basic skills and knowledge on the use of computers and computer applications.	2.1 Recognize logical and physical organization of a general-purpose computer. 2.2 Apply different word processing techniques such as creating, editing saving and retrieving a document. 2.3 Add special features to a document, working with blocks, indenting and aligning text. 2.4 Draw up spread sheets commands to deduce formulae and other mathematical techniques. 2.5 Use and maintain a personal computer's database and storage facilities. 2.6 Demonstrate knowledge and understanding of communication technology.
3. Translate objects in space, their interactions and disposition for better mastery of engineering drawings	3.1 Demonstrate an understanding of basic terminology in graphics. 3.2 Interpret different scales used in engineering drawing. 3.3 Apply free hand drawing techniques and perspective drawing intersections. 3.4 Draw in three dimension and two dimensions. 3.5 Apply, orthogonal, axonometric, and Isometric projections to 3D and 2D diagrams.
4. Apply principles in engineering in order to develop correlation between concepts in physics and other modules.	4.1 Apply basic physical quantities using standard metric systems in optics, weight, density, and sound. 4.2 Demonstrate an understanding of the effects of objects that are constantly in motion. 4.3 Apply different laws of dynamics to determine resultant forces. 4.4 Apply physics law that govern energy and its effects on different matter states. 4.5 Produce graphical representations of Electromagnetic Radiation and Electromagnetic Waves. 4.6 Demonstrate knowledge and understanding of, mass and energy, nuclear reactions, ionizing radiation and health, balance of the planet and energy in nature.
5. Demonstrate sound understanding and knowledge of	5.1 Demonstrate knowledge and understanding of properties of construction materials.

various materials used in construction works	5.2 Evaluate the manufacturing process of general construction materials. 5.3 Determine all environmental impacts on construction materials during manufacturing process and final usage.
6. Apply basic construction apprentice practical competencies	6.1 Lay stock bricks using different techniques such as raking back, toothing etc. 6.2 Set out using pegs for stock bricks. 6.3 Mix water, cement, and aggregates at required portions. 6.4 Administer basic painting and rendering skills to finish surface. 6.5 Lay PVC pipes in residential water system. 6.6 Install mechanical valves and water chambers. 6.7 Inspect finished works in basic plumbing, brick laying and painting. 6.8 Construct temporary and permanent joining such as soldering, welding, brazing and in wood. 6.9 Wire a residential house and install electrical appliances and electrical boards.
7. Illustrate the effectiveness of oral and written communication through varied of media.	7.1 Write effective and concise letters and memos employing appropriate business format. 7.2 Prepare informal and formal reports that include analysis and offer recommendations. 7.3 Participate in meetings and conduct proper techniques in telephone usage. 7.4 Summarize personal achievements and skills in appropriate formats for future employers or academic institutions. 7.5 Perform effectively in interviews. 7.6 Prepare and deliver an oral presentation utilizing electronic software. 7.7 Observe the impact of language usage on applying business etiquette to a variety of professional situations. 7.8 Recognize the importance of cultural differences and how they affect communication in a business environment.
8. Apply mathematical concepts which are directly related to the application of engineering concepts.	8.1 Calculate Laplace transforms and inverses. 8.2 Apply Laplace transformations to solutions of differential and integral equations.

	8.3 Calculate double and triple integrals, surface integrals and apply the Green's, Stokes. 8.4 Deduce Divergence theorems and calculate complex integrals 8.5 Apply physical significance of vector calculus, parameterize curves, calculate line integrals and use vector operators
9. Apply basic principles and techniques used in computer aided design and manufacturing process.	9.1 Draw basic diagrams using auto cad draw and modifying commands. 9.2 Apply and use database information for objects in order to modify, store, manipulate and detailing. 9.3 Work with line type styles, modify and manipulate line sizes
10. Demonstrate a sound understanding of the properties of industrial construction materials and the manufacturing processes.	10.1 Recognize and understanding the use of concrete composition, mixing ratios, preparation procedures and curing. 10.1 Realize the impact of concrete when reinforced, what type of materials are used to reinforce, and the process of reinforcing concrete. 10.3 Identify different road construction materials classification, properties and placing conditions.
11. Illustrate proficiency in reading, understanding general and technical English, and communicate effectively both orally and in writing.	11.1 Make oral presentations using technological advancements. 11.2 Produce high quality technical reports. 11.3 Read and understand various professional journals and newsletters 11.4 Produce high quality technical reports 11.5 Use of statistical and other official documents,
12. Apply the concepts of locating points on the surface of the earth using optical instruments.	12.1 Take reduce levels over a specified area. 12.2 Deduce levels using rise and fall method and HPC method. 12.3 Deduce statistical errors using different techniques not limited to standard deviation and sequential errors. 12.4 Measure linear distances using different measuring instruments and determining amount of error incurred. 12.5 Set out boundaries using automatic level. 12.6 Measure vertical and horizontal angles using Theodolite and Total Station. 12.7 Apply traversing techniques using Theodolite.

13. Illustrate proficiency in apprentice skills of plumbing and pipe fitting.	13.1 Install taps and fit valves. 13.2 Cut and bend GS pipes to required or proper specifications. 13.3 Join and assemble GS pipes, PVC, and Polyethylene (PEH) pipes and fittings. 13.4 Join and fit PVC ND PEH and Cast-iron fittings/concrete pipes. 13.5 Service connections and design sewer connections. 13.6 Construct valve chambers.
14.Identify and analyse the components of a building, the construction and integration of construction members to hence the pre-requisite skills in producing drawings.	14.1 Define structural concepts and forms of construction. 14.2 Demonstrate knowledge and understanding of the sub-structure including construction/erection application of finishes, structural requirements and uses. 14.3 Demonstrate knowledge of the superstructure including and not limited to simple pitched timber, steel-roof systems, and roof coverings in general. 14.4 Demonstrate competencies in flat concrete and timber-roof construction details and coverings. 14.5 Demonstrate knowledge and understanding in Terminology, layout of staircases. 14.6 Identify and apply construction methods and details of timber, steel and concrete staircases. 14.6 Identify and evaluate types of uses and application of in-situ tile/block/slab and sheet finishing. 14.7 Determine and evaluate criteria for selection of finishes.
15. Demonstrate competency in the use of computers in graphic design and have understanding on how to create and edit 2-dimensional drawings as well on how to create and edit 3-dimensional drawings.	14.8 Draw advanced diagrams using auto cad draw and modifying commands. 14.9 Apply and use database information for objects in order to modify, store, manipulate and detailing. 14.20 Work with line type styles, modify and manipulate line sizes.
16. Apply basic concepts of solid mechanics in particular stress, strain and stability.	16.1 Demonstrate understanding of the different types of forces and the reaction of solids to external force. 16.2 Calculate the reaction of solid bodies when subjected to external forces.

	16.3 Draw-shear force diagrams and bending moment diagrams. 16.4 Compute geometrical properties of sections by drawing by calculating moment of inertia. 16.5 Apply and calculate normal stresses in beams, shear stresses in beams and plastic bending of beams. 16.7 Demonstrate knowledge in introduction and stability of columns.
17. Apply advanced knowledge, skills and competencies in the construction work-based environment.	17.1 Identify and solve problems, experienced with resources, systems and stakeholders. 17.2 Demonstrate scientific and technological competence within the various areas in civil engineering. 17.3 Demonstrate understanding of contextual world systems and the impact of civil engineering projects and stakeholders in the environment. 17.4 Communicate and work effectively with the stakeholders. 17.5 Manage information effectively. 17.6 Co-ordinate and manage team assigned tasks. 17.7 Employ self-management and reflect on own performance and areas of improvement.
18. Test soils to determine the adequacy and strength of foundations	18.1 Compile technical and safety data reports to support planning permissions and license applications. 18.2 Profile soil to determine suitability of the soil and assess whether it can accommodate your construction project such as sieve analysis, compression test etc. 18.3 Compile results and observe the development of the soil throughout your construction project for maximum quality and safety. 18.4 Test soil for strength, density, compaction, contamination, organics and sand content, and assess their impact on your construction project.

19. Apply architectural working tools and equipment employing Computer Aided Design (CAD) graphics and presentation skills.	19.1 Demonstrate competency in the use of hand and machine equipment of a building workshop and simple construction and installation methods. 19.2 Define basic terms used in graphic drawing: point, line, plane and volume. 19.3 Draw detailed diagrams in isometric, orthographic and axonometric projections. 19.4 Draw assembly mechanical drawings. 19.5 Apply perspective drawing and shadow projections.
20 Analyse survey reports, maps, and other data to plan projects.	20.1 Measure height differences using levels by observing and recording of staff readings relative to datum/sea level using dump or automatic, digital level. Setting up tripod, centralizing bubble tube and carrying out a two-peg test. 20.2 Determine height differences across wide gaps using rectangular co-ordinates applying grid north, magnetic north, true north, orientation, whole circle bearings, rectangular co-ordinates. Adjustment should be made to bearings. 20.3 Demonstrate thorough knowledge of survey instrument and topographical and cadastral surveys. 20.4 Carry out levelling surveys in preparation of site plans. 20.5 Carry out setting out of buildings, roads, waterlines, and other infrastructure.
21. Demonstrate advanced understanding of the components of a building and the construction and integration of construction members.	21.1 Explain soil-mechanics and complex foundations. 21.2 Evaluate materials for form-work and essential requirements for economy. 21.3 Demonstrate knowledge and understanding types, constructional methods, and detailing of ground floors. 21.4 Determine principles, method and applications of forces acting on buildings.
22. Apply knowledge and demonstrate technical proficiency in structural elements commonly encountered in	22.1 Demonstrate competency in structural design mathematical models and forces. 22.2 Calculate concurrent, coplanar forces, using triangular forces, parallelogram of forces, rectangular components, and polygon of forces.

engineering practice, their behaviour under load and the actions to be taken to mitigate for failure,	22.3 Calculate of non-concurrent using coplanar forces, the link polygon, and application of the link polygon. 22.4 Calculate moments of forces, measurements of moments, conditions of equilibrium, resultant of parallel forces, couples, and beam reactions. 22.5 Analyse framed structures, determine their stability, calculate determine resultant forces. 22.6 Draw bending moment and shear force diagrams using resultant forces calculated. 22.7 Assess the structural behaviour of Steel structures under stress, strain and in tension. 22.8 Assess sectional properties of regular and irregular objects. 22.9 Design of simply supported RCC beams using limit state method.
23. Demonstrate understanding of mechanical properties of fluids (liquids and gases) under static and dynamic conditions, and their behaviour under different loading conditions and variations in temperature and pressure.	23.1 Display an understanding on kinds of fluids-real, ideal shear stress, viscosity, Newtonian and non-Newtonian fluids, and fluid properties. 23.2 Assess fluids at zero motion using hydrostatic equation, pressure and density in gravitational field, fluid forces, and buoyancy and stability. 23.3 Assess fluids at motion by angular momentum, kinematics and general laws of motion. 23.4 Calculate mass conservation using, continuity equation and Reynolds' theorem. 23.5 Calculate momentum conservation using external forces, momentum equation, momentum for steady state and uniform flow, unsteady state and uniform flow. 23.6 Assess energy conservation taking into account potential flow.
24. Facilitate physical participation in lightweight construction trades.	24.1 Critically identify areas which could be done differently to enhance productivity on a construction project. 24.2 Explain the major difference between the classroom set-up and the field/site set up. 24.3 Demonstrate understanding of labour relations.
25. Apply basic concepts of the design and	25.1 Assess accurately preliminary considerations when building urban and rural roads.

construction of both rural and urban roads.	25.2 Critically assess social-economic aspects of road construction taking into consideration environmental impact, technical considerations, and material considerations. 25.3 Analyse all legal implications to be encountered when constructing a road. 25.4 Design basic soft pavements taking into consideration geometric design parameters, horizontal alignment, vertical alignment, super elevation, and cross-sectional elements.
26. Apply design techniques on design of basic reinforced concrete structural elements.	26.1 Design simply supported beams using limit state method. 26.2 Assess and calculate beam deflections considering beam detailing and design. 26.3 Design axially loaded RCC beams using limit state method.
27. Apply design techniques on design of basic reinforced concrete structural elements focused on the different types of foundation.	27.1 Assess critically all principles involved in foundation design including bearing pressure using limit state method. 27.2 Analyse ground investigation techniques, site clearance, ground improvement techniques and soil tests. 27.3 Identify different types of foundations, requirements of each as well as selection criteria. 27.4 Design pile, strip, and raft foundation.
28. Carry out design of the scheme, including production of engineering drawings.	28.1 Produce detailed civil engineering drawings based on a temporary Endeavour or need in the community. 28.2 Produce a written proposal based on civil engineering project. 28.3 Produce a model or prototype of proposed project. 28.4 Create a water and wastewater detailed drawing mirrored by a well know project in the community.
29. Establish the characteristics of potable water, assess the need for treatment or otherwise, analyse treatment options and come up with the optimum treatment process.	29.1 Analyse the basic design considerations preconstruction of a water treatment structure. 29.2 Assess water treatment methods, selection criteria and chemical treatment processes. 29.3 Develop an understanding of special water treatment processes common practiced in the region. 29.4 Design and detail a hydraulic structure involved in water and waste engineering.
30. Comprehend the dynamics, function and	30.1 Develop a basic understanding of electrical fitting and installation in a residential home

fitting of the electrical, plumbing and drainage and other services installations in buildings; with respect to design of installations norms and codes of installations as well as skills in the computation and choice of materials.	30.2 Apply design considerations in water supply, sanitary services and wastewater supply 30.3 Analyse fire proofing, fire controlling, fire detection and fire warning systems. 30.4 Display thorough knowledge of refuse disposal in residential, commercial, and industrial areas. 30.5 Assess air supply, ventilation both artificial and natural. 30.6 Determine vertical transportation systems selection criteria including and not limited to, lifts, escalatorsHoists and paternoster. 30.7 Formulate logistics strategies for installing and using information technology and wireless form of communication. 30.8 Produce and effectively combine the options available for security and burglar alarm systems for buildings or structures.
31. Compile project activities and supervising tendering procedures.	31.1 Draw up a qualified bill of quantities using dimension paper. 31.2 Draw up an estimation of expected costs in a construction project. 31.3 Produce a pre-tender programme for use by the Estimating Department.
32. Test the relationship between the artificial built-up environment and a naturally occurring environment.	32.1 Assess thermal principles based on properties, measurement, elementary heat transfer humidity and vapour pressure. 32.2 Determine the dew point gradient saturation and condensation. 32.3 Demonstrate knowledge of climatic conditions caused by artificial built-up environments. 32.4 Assess accurately human reactions to environmental factors 32.5 Test design principles for climate zones.
33. Apply the principles of road construction, and design which type of road is provided.	33.1 Identify construction plant and equipment used during highway or road construction. 33.2 Apply all sub-grade excavation principles including, placing, spreading, watering and compaction of fill 33.3 Determine the selection criteria for road drainage systems, such as channels culverts and bridges. 33.4 Apply knowledge in earth movement and earth mining including site cutting and filling. 33.5 Asses all possible ground treatment and ground improvement techniques.

34. Asses the design of foundation for any structure, design raft foundations and initiate selection criteria, design pile foundation and identify foundation treatment methods.	34.1 Design and detail Raft Foundations using limit state method. 34.2 Asses the treatment and contamination implications of the foundations. 34.3 Design Pile foundation. 34.4 Assess ground improvement techniques.
35. Prepare a civil engineering project proposal to a panel based on a need or want in the community.	35.1 Design a residential building with emphasis on housing functions, and the understanding of construction technology. 35.2 Design a civil engineering facility (water supply system, sewerage or road) with the focus on the site layout, site suitability and all the relevant factors acquired from the relevant course.
36. Design a water pump station to specifics guided by needs in community.	36.1 Design and detail a water pump using limit state method including pump machinery requirements. 36.2 Assess water and wastewater treatment process and systems in a given locality.
37. Design artificial water bodies applying limit state method for RCC structures.	37.1 Design simple hydraulic structures. 37.2 Assess the effects of horizontal forces including and not limited to wind pressure, liquid pressure, soil pressure and abnormal forces. 37.3 Critically analyse structural stability considering all possible modes of failure. 37.4 Design prestressed structures using limit state method.
38. Calculate construction cost estimation of labour, equipment and materials	38.1 Calculate wage rate for labour for a given project. 38.2 Calculate cost estimation of materials and equipment of a construction project. 38.3 Prepare a bill of quantities for a construction project. 38.4 Prepare tender documents for a construction project.
39. Present findings to the public and/or client on topics such as bid proposals, environmental impact statements, or property descriptions.	39.1 Interpret environmental impact assessment report from authority, council or governing body. 39.2 Conduct thorough soil investigation during site reconnaissance 39.3 Liaise with geotechnical experts on findings of soil tests.

40. Critically evaluate an OHS report, assess the suitability of the proposed occupational health and safety plan and assess the adequacy or otherwise of the proposed mitigation measures.	40.1 Demonstrate basic competency in and understanding of Occupational Health and Safety legislation 40.2 Apply Hazardous Materials Management concepts in a construction site. 40.3 Explain all Occupational Health related diseases. 40.4 Implement all Environmental Safety precautions prior a construction project.
41. Undertake methods for management planning and control of projects in the course of construction production	41.1 Explain in detail construction project management concepts based on time, quality, and cost. 41.2 Analyse the work break down structure. 41.3 Apply project network modelling and analysis and project work scheduling. 41.4 Identify principles in management for project work scheduling. 41.5 Assess methods or strategies for site organization including a timely program, site layout and channels of communication. 41.6 Manage site materials, equipment, and staff. 41.7 Apply safety, and occupational health hazards principles. 41.8 Identify accidents causes and prevention for construction site. 41.9 Select or procure construction plant and equipment.
42. Demonstrate specialised knowledge by applying the concept of steel and timber design under limit state method.	42.1 Design and detail all components of structural timber. 42.2 Critically analyse effects of different loads on structural timber. 42.3 Design flexural members of timber. 42.4 Design compression members of structural timber 42.5 Design tension members of structural timber 42.6 Apply support modes for structural timber. 42.7 Design steel structures 42.8 Design steel in flexural members 42.9 Design compression members of steel 42.10 Design and detail bolted and welded connections
43. Demonstrate knowledge of compliance with, state, and local legal requirements by studying and implementing existing and new	43.1 Interpret all forms of contract under FIDIC or any recognized forms of contract. 43.2 Interpret all laws under building regulations. 43.3 Produce terms of any construction project pretender phase.

legislation; anticipating future legislation; enforcing adherence to requirements; advising management and project teams on needed actions.	
44. Provide sound technical advice on construction project and creatively resolve any emerging technical conflicts.	44.1 Apply project management skills to resolve technical conflicts in civil or construction project. 44.2 Organize and conduct coordination meetings for construction projects. 44.3 Organize and oversee site meetings with all key stakeholders. 44.4 Produce detailed project program with constant updates. 44.5 Identify key marketing strategies for a construction project. 44.6 Inspect and implement quality control. 44.7 Procure essential materials, plant and equipment.
45. Demonstrate both academic quality and ability to carry out a substantial piece of independent research and/or development work,	45.1 Present a proposal or ideal envisaged through a power point or a simple model. 45.2 Conduct thorough research through the right modes of information and data collection and data analysis. 45.3 Present a comprehensive report and findings supported by visual presentation.
46. Apply construction law principles in contract law and dispute resolution.	46.1 Assess and interpret employment contracts in a construction project 46.2 Spearhead dispute resolutions on site and through project briefing meetings. 46.2 Demonstrate all steps involved through arbitration and due process in a construction project.
47. Prepare study by analysing engineering design, conducting environmental impact studies, assembling data.	47.1 Conduct market research to determine project viability. 47.2 Produce documentation such as the business case, project execution plan and strategic brief. 47.3 Produce appraisals, including geotechnical studies, assessment of any contamination, availability of services, uses of adjoining land, easements and restrictive covenants, environmental impact. 47.4 Present full data results, and analysis of the final project

48. Set up business/practice as alternative to looking for employment and have the basic principles of setting up and running a construction related business.	48.1 Demonstrate thorough knowledge in setting up a construction company or firm. 48.2 Demonstrate thorough knowledge in all the preliminary processes required when setting up business. 48.3 Assess and interpret different grades of construction and civil engineering projects. 48.4 Manage a business small scale construction company.
49. Interpret and apply the basic concepts of operation research, undertake risk analysis of any undertaking and explain how to put in place measures to mitigate risks	49.1 Carry out a formal risk assessment based on operational research. 49.2 Demonstrate thorough knowledge in risk assessment. 49.3 Produce detailed project program risk response plan and risk mitigation techniques. 49.4 Distinguish clearly risk response plan and risk response control. 49.5 Utilize Microsoft project software and applications in risk management.

QUALIFICATION STRUCTURE: SECTION C			
FUNDAMENTAL COMPONENT Subjects / Units / Modules /Courses	**Title**	**Level**	**Credits**
	Engineering Mathematics I	6	10
	Introduction to Computers & Programming	5	9
	Engineering Materials I	5	6
	Physics	6	8
	Chemistry	6	8
	Communication Skills I	5	6
	Communication Skills II	5	6
	Engineering Mathematics II	7	10
	Computer Aided Design	7	9
	Engineering Materials II	6	9
	Engineering Drawing I	7	9
CORE COMPONENT	Geology for Engineers	7	6
	Foundation Engineering I	7	8

Subjects / Units / Modules /Courses	Foundation Engineering II	7	10
	Environmental Science	7	6
	Engineering Mathematics III	7	12
	Engineering Mathematics IV	7	12
	Engineering Surveying I	7	10
	Engineering Mechanics-Statics	7	6
	Engineering Thermodynamics	7	8
	Principles of Electrical Engineering	7	8
	Engineering Surveying II	7	10
	Mechanics of Materials and Structures	7	9
	Engineering Dynamics	7	8
	Fluid Mechanics	7	8
	Soil Mechanics	7	8
	Geotechnical Engineering	7	9
	Hydraulics	7	8
	Structural analysis	7	8
	Water Supply Engineering	7	8
	Wastewater Engineering	7	10
	Transportation engineering	7	9
	Building Construction I	6	6
	Building Construction II	7	6
	Building Services	7	6
	Road Design and Construction I	7	8
	Road Design and Construction II	7	10
	Design of Reinforced Concrete Structures	7	9
	Design of Steel Structures	7	8
	Foundation Design	7	8
	Hydraulics Structure	7	8
	Engineering Drawing II	7	9
	Workshop Practical Training I	6	9
	Workshop Practical Training II	6	9

	Professional Practice and Ethics	7	7
	Contract Procedures and Administration	7	8
	Fundamentals of Infrastructure Management	7	7
	Project planning techniques	7	9
	Construction Law and Law of Contract	7	8
	Entrepreneurship	7	6
	Construction Management	7	8
	Measurement & Costing of Construction Works	7	8
	Final Project I (Research Methodology)	7	8
	Final Project II	7	10
	Industrial Training I and II	7	20
ELECTIVE COMPONENT Subjects / Units / Modules /Courses	**CHOOSE 2**		
	Risk Management	6	6
	Health, Safety & Environmental Issues in Construction	6	6
	Advanced Engineering Materials	7	6
	Advanced Water Engineering	7	6
	TOTAL CREDITS		**480**

Rules of combinations, Credit distribution

Fundamental component = 81

Core component = 387

Elective component = 12

Total Credits = 480.

ASSESSMENT AND MODERATION ARRANGEMENTS

Assessment and moderation shall be conducted by BQA registered assessors and moderators.

Assessment

Formative assessment shall make 60%.

Summative assessment shall make up the remaining 40%.

Moderation

All assessment tools shall undergo internal and external moderation. The internal and external moderation shall be conducted as ETP policies.

RECOGNITION OF PRIOR LEARNING

There will be provision for awarding this qualification through RPL and CAT in accordance with national and institutional policies.

PROGRESSION PATHWAYS

Learning Pathways

Vertical articulation;

- Master of Science in Civil Engineering (Water and Wastewater Engineering)
- Master of Science in Civil Engineering (Construction Management).
- Master of Science in Civil Engineering (Environmental Engineering)
- Master of Science in Civil Engineering (Structural Design)
- Master in Project Management (MPM)

Horizontal articulation:

- Bachelor of Science in Environmental Engineering
- Bachelor of Engineering in Civil Engineering
- Bachelor of Architectural Science
- Bachelor of Science in Structural Planning

Employment Pathways

Upon successful completion of this qualification, the graduate can be absorbed in the following disciplines at entry level as;

- Site Engineer

- Resident Engineer (Technologist)
- Principal Agent
- Estimator
- Site Agent
- Road Engineer (Technologist)
- Facilities Manger
- Materials Testing Engineer (Technologist)
- Contracts Manager
- Cost Manager

QUALIFICATION AWARD AND CERTIFICATION

The candidate should attain a minimum of 480 credits of this qualification and satisfy the rule of combination above, to be awarded a qualification of **BACHELOR OF CIVIL ENGINEERING TECHNOLOGY IN CONSTRUCTION.**

Graduates will be issued with certificates and transcripts.

REGIONAL AND INTERNATIONAL COMPARABILITY

The Bachelor of Civil Engineering Technology in Construction was benchmarked against similar qualifications from other institutions regionally and internationally. The benchmarking process considered the exit outcomes, modules, total credits, and level.

Bachelor of Technology in Civil Engineering (Vaal University of Technology, South Africa

The qualification level when mapped onto the NCQF equates to the level of the proposed qualification, NCQF level 7. The main exit outcomes and modules are centered around the core of the qualification which is civil engineering. Such modules are similar to those of the proposed qualification, and they include Hydraulics, Research, Water engineering, Structural Steelwork, Computer Methods in Structures, Foundations on Problematic Soils and many others. However, the terminology of similar modules is different in some modules as well as total credits of the qualification.

Bachelor of Technology Building Construction (Technical University of Kenya, Kenya)

Although the credits (460) allocated to this qualification are different to those of the proposed qualification, the qualification are similar in terms of field/area of knowledge and skills. The exit outcomes and modules are more on construction. Almost all the modules in this qualification are also available in the proposed qualification though some names are different.

Bachelor of Technology in Civil Engineering (Melbourne Polytechnic, Australia) AQF level 7 of this qualification equates to level of the proposed qualification when mapped onto the NCQF. The exit outcomes and modules of both qualifications are similar though some are differed on names. They are all centered around civil engineering.

A comparison of the proposed qualification with the above shows that the qualification learning outcomes compares favourably with other qualifications of similar nature from other countries. Moreover, the proposed qualification has an industrial attachment and project modules.

REVIEW PERIOD

The qualification will be reviewed every 5 years.