| SECTION A: | QUALIFICATION DETAILS | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QUALIFICATION DEVELOPER (S) | Botswana International University of Science and Technology | | | | | | | | | | | | | | | | |
| TITLE | Bachelor of Science in Applied Geology | | | | | | | | | | | | | NCQF LEVEL | | | |
| FIELD | Natural, Mathematical and Life Sciences | | SUB-FIELD | Geology | | | | | | | | | | CREDIT VALUE | 528 | | |
| 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

Mineral resources dominate the Botswana economy (diamonds, copper/nickel and coal) as well as most African countries and this will continue into the foreseeable future [2]. Indeed, not only will the current activity be sustained but it will be increased by diversification in terms of types of mineral resource (e.g. gold, silver, uranium), gas production and geothermal capacity [1, 2]. It is very important that this 'bedrock' of the economy is maintained and enhanced through innovative and substantial downstream processing. This needs high-level skilled manpower in the geological sciences. Moreover, according to the Botswana National Human Resources Strategy [3], Botswana needs highly skilled manpower to play a major developmental role in the mineral sector. In the last decade, the country has endeavoured for a sustainable development of the economy that can only be achieved with thorough sustainable management of natural resources such as minerals and water.

This qualification, therefore, will meet the demands in Botswana, SADC and worldwide for high-level skilled manpower in the mining sector, water accounting and natural resources management. The holder of this qualification will pursue a career in the exploration and resource development of minerals (metallic and non-

metallic), energy (coal and geothermal) and water (groundwater and surface water systems). The qualification will produce professional geoscientists in a range of careers in mineral exploration, mining and quarrying, geosciences information analysis, and engineering consultancy. As a result, the qualification is in line with BIUST strategy of producing innovative highly skilled manpower to drive a knowledge-based economy. Graduates from the qualification are qualified to pursue postgraduate studies internationally, either at Master's Degree level, usually with a particular specialized career path in mind, or at doctorate level.

*1.http://allafrica.com/stories/201603090673.html*

*2.Botswana Mining Sector Investment and Business Guide: Volume 1 Strategic Information and regulations (2012). Reprinted International Business Publication USA ISBN 1-4330-2454-3*

*3.National Human Resource Development Strategy, 2009-2022: Realizing Our Potentials. Ministry of Education and Skills Development, 2009*

*4. VISION 2036 – Achieving Prosperity For All. Prepared By The Vision 2036 Presidential Task Team, July 2016. Publishers, By Lentswe La Lesedi (Pty) Ltd. Copyright © Government Of Botswana*

***PURPOSE:***

The purpose of this qualification is to provide graduates with specialised knowledge, advanced technical skills, and competencies to:

- Demonstrate advanced knowledge of the processes that affect the evolution, structure and composition of the Earth.
- Demonstrate advanced knowledge of the principles of stratigraphy and the relationships between rock bodies.
- Apply advanced and practical skills of field work methods to acquire detailed geological data and locate natural resources in the earth's crust.
- Select principles, procedures, and adequate scientific approaches in a variety of complex situations.
- Conduct analytical procedures, technical processes, and the use of laboratory equipment appropriate to the discipline in a safe, accurate and precise manner.
- Review critically existing geoscience information that is pertinent to the solution of a given geological problem.
- Synthesise and interpret a multi-array of geological and physical data of geoscience.?
- Apply advanced chemical, physical, geological, and mathematical concepts to build a systematic understanding of geological processes/events.
- Communicate scientific results in an effective and detailed manner.
- Apply professional code of ethics in the daily practice of the profession.
- Share and understand individual responsibilities while working in a team. Identify the opportunities and challenges of entrepreneurship in the broad field of applied geoscience

| ***ENTRY REQUIREMENTS (including access and inclusion)*** |
|---|
| The minimum entry requirement is:<br>Certificate IV, NCQF level 4 (General Education or TVET) or equivalent.<br><br>Access through Recognition of Prior Learning (RPL) and Credit Accumulation and Transfer (CAT) will be provided through ETP policies in line with National RPL and CAT Policies |

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| ***SECTION B*** | ***QUALIFICATION SPECIFICATION*** |
|---|---|
| ***GRADUATE PROFILE (LEARNING OUTCOMES)*** | ***ASSESSMENT CRITERIA*** |
| LO1. Demonstrate specialised knowledge of the processes that affect the evolution, structure, and composition of the Earth. | 1.1. Apply the paradigm of plate tectonics to the study of processes that affect the Earth.<br>1.2. Affect crystallographic principles, systematic mineralogy and structural features to identify and quantify rock types both in the field and in the laboratory.<br>1.3. Assess the ore minerals, industrial minerals, and other mineral resources of a given area. |
| LO2. Apply a range of advanced principles of stratigraphy and tectonic for the characterization of sedimentary basins and complex geological problems. | 2.1. Relate the principles of lithostratigraphy to the description of rock units in the field and in the laboratory (drill cores).<br>2.2. Categorize rock deformation processes and their causative factors both in the field and in the laboratory.<br>2.3. Assess the architecture of sedimentary basins and their evolution through space and time. |
| LO3. Apply advanced and practical skills of field work methods to acquire detailed geological data and locate natural resources in the earth's crust. | 3.1. Utilize advanced geophysical, geochemical, and other geological tools to the collection of field data.<br>3.2. Conduct geological field work, (geochemical, geophysical, hydrogeological, structural, etc.,) using various pieces of equipment and methods. |
| LO4. Select principles, procedures and adequate scientific approaches in a variety of complex situations. | 4.1. Categorize Internal and external factors to a particular geological problem and find possible solutions.<br>4.2. Validate different spatial and temporal scale as well as the capacity to link specific problems to a broader scenario.<br>4.3. Manage scientific problems in a multidisciplinary approach. |

| | |
|---|---|
| LO5. Conduct analytical procedures, technical processes, and the use of laboratory equipment appropriate to the discipline in a safe, accurate and precise manner. | 5.1. Undertake data analyses using a full array of laboratory apparatus for the characterization of geological materials.<br>5.2. Process data coming from laboratory experiments devised for answering specific scientific questions.<br>5.3. Interpret geological, geochemical and geophysical data from first-hand experiments. |
| LO6. Review critically existing geoscience information that is pertinent to the solution of a given geological problem. | 6.1. Evaluate existing literature on specific geological topics.<br>6.2. Conduct a gap analysis of the existing literature data.<br>6.3. Assess possible tools for filling the knowledge gap.<br>6.1. Compile data from different sources into a complete scientific report. |
| LO7. Apply advanced chemical, physical, geological, and mathematical concepts to build a systematic understanding of geological processes/events. | 7.1. Process geoscience data using relevant software systems.<br>7.2. Merge the information for coherent and consistent interpretation of the geological observations.<br>7.3. Interpret critically case studies of exploration, mining or other projects that geologist participates. |
| LO8. Communicate scientific results in an effective and detailed manner. | 8.1. Deliver good quality presentation of scientific reports using appropriate academic or professional discourse. |
| LO9. Apply professional code of ethics in the daily practice of the profession. | 9.1. Categorise ethics and professional responsibilities of the geologist involved in projects. |
| LO10. Demonstrate the ability to share and understand individual responsibilities while working in a team. | 10.1. Recognise the roles, motives and viewpoints of team members.<br>10.2. Exercise leadership qualities and independent thinking while working with a team.<br>10.2. Manage conflict with a view to dispute resolution. |
| LO11 Recognize the opportunities and challenges of entrepreneurship in the broad field of applied geoscience | 11.1. Develop a proposal for setting of a company in the field of Applied Geology.<br>11.2. Establish a work plan for managing a company in the field of Applied Geology. |

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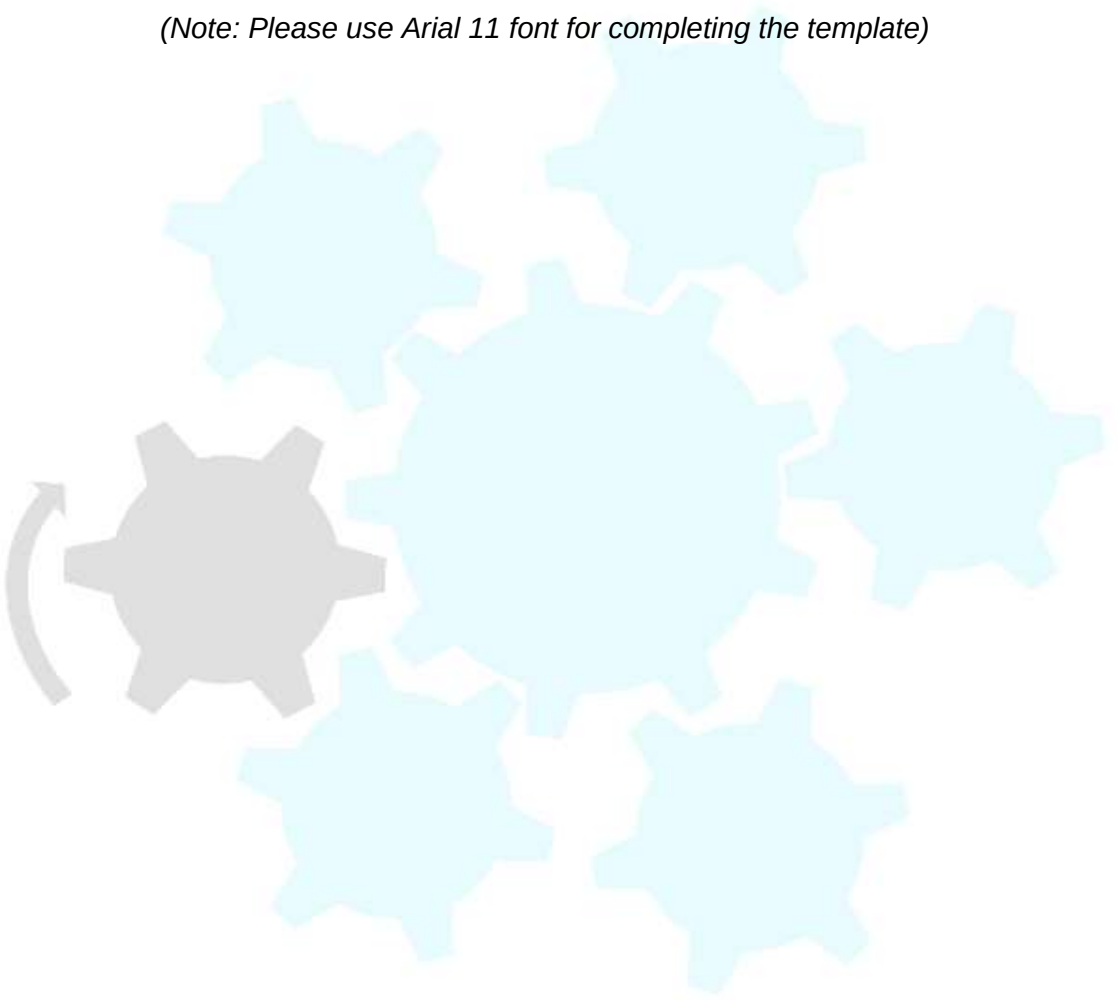

| ***SECTION C*** | ***QUALIFICATION STRUCTURE*** | | | | |
|---|---|---|---|---|---|
| ***COMPONENT*** | ***TITLE*** | ***Relevant NCQF Level*** | | | ***Total Credits*** ***(Per** Subject/ Course/ Module/ Units)* |
| | | ***Level [ 5 ]*** | ***Level [ 6 ]*** | ***Level [ 7 ]*** | |
| ***FUNDAMENTAL COMPONENT*** *Subjects/ Courses/ Modules/Units* | Principles of Biology I | 12 | | | 12 |
| | General Chemistry I | 12 | | | 12 |
| | Introduction to Computing | 12 | | | 12 |
| | Pre-Calculus I | 12 | | | 12 |
| | Introduction to mechanic | 12 | | | 12 |
| | Introduction to Technical Communication and Academic Literacy | 6 | | | ***6*** |
| | Pre-Calculus II | 12 | | | ***12*** |
| | Introduction to Electricity and magnetism | 12 | | | ***12*** |
| | Writing process | 6 | | | ***6*** |
| | Principles of Biology II | | 12 | | ***12*** |
| | General Chemistry II | | 12 | | ***12*** |
| | Introduction to Calculus | | 12 | | ***12*** |

| | | | | | |
|---|---|---|---|---|---|
| ***CORE COMPONENT*** *Subjects/Courses/ Modules/Units* | Introduction to Analytical Chemistry | | 12 | | ***12*** |
| | Calculus for Applied Sciences I | | 12 | | ***12*** |
| | Calculus for Applied Sciences II | | 12 | | ***12*** |
| | Technical and Professional Communication | | 6 | | ***6*** |
| | Physics for Earth and Environmental Sciences | | 12 | | ***12*** |
| | Statistics for Environmental and Earth and Environmental Science | | 12 | | ***12*** |
| | Chemical bonding and periodicity | | 12 | | ***12*** |
| | Introduction to Entrepreneurship | | 6 | | ***6*** |
| | Earth and its Materials | | | 12 | ***12*** |
| | Earth Surface Processes & Landforms | | | 12 | ***12*** |
| | Mineralogy and Mineral Microscopy | | | 12 | ***12*** |
| | Introduction to Structural Geology and Field Methods | | | 12 | ***12*** |
| | Field mapping and reporting | | | 12 | ***12*** |
| | Igneous Petrology | | | 12 | ***12*** |

| | | | | | |
|---|---|---|---|---|---|
| | Sedimentology and sedimentary petrography | | | 12 | ***12*** |
| | Structural Geology and Tectonics | | | 12 | ***12*** |
| | Principles of Hydrogeology | | | 12 | ***12*** |
| | Geographic information systems and data bases | | | 12 | ***12*** |
| | Management and Entrepreneurship Concepts and Principles | | | 6 | ***6*** |
| | Principles of Geochemistry | | | 12 | ***12*** |
| | Fundamentals of Geophysics | | | 12 | ***12*** |
| | Metamorphic Petrology | | | 12 | ***12*** |
| | Research methods in Earth and Environmental Sciences | | | 12 | ***12*** |
| | Stratigraphy and Paleontology | | | 12 | ***12*** |
| | Starting and Sustaining a Business | | | 6 | ***6*** |
| | Advanced field mapping and reporting | | | 24 | ***24*** |
| | Geology of Botswana and Southern Africa | | | 12 | ***12*** |
| | Geology of Ore Deposits | | | 12 | ***12*** |

| | | | | | |
|---|---|---|---|---|---|
| | Hydrogeology and Water Resources | | | 12 | ***12*** |
| | Internship | | | 36 | ***36*** |
| ***ELECTIVE/ OPTIONAL COMPONENT***<br>*Subjects/Courses/ Modules/Units* | Mine waste management | | | 12 | ***12*** |
| | Soil mechanics | | 12 | | ***12*** |
| | Mining regulations | | | 12 | ***12*** |
| | Starting and Sustaining a Business | | | 6 | ***6*** |
| | Developing a Strategic Business Plan | | | 6 | ***6*** |
| | Entrepreneurship in a Specific Context | | | 6 | ***6*** |

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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*** | ***96*** |
| ***Level 6*** | ***120*** |
| ***Level 7*** | ***312*** |
| ***TOTAL CREDITS*** | ***528*** |

***Rules of Combination:***

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

The qualification will be articulated over 4 years and will include and advanced field mapping and reporting module at year 4. Each year will consist of minimum of 120 credits as per BQA regulation.

Year 1 is considered as introductory and will consist of a total of 96 credits at Level 5 and 36 credits at Level 6 for a total of 132 credits.

Year 2 will cover more specifically geo-oriented topics with 84 credits at level 6, and the remaining 48 credits at level 7 for a total of 132 credits.

Year 3 comprises of 132 credits all at level 7.

Year 4 is dedicated to applied geoscience and it will be of 132 credits, all at level 7 including a 48 credits internship offered during the second semester. There will be only 12 credits during the first semester of year IV allocated for elective modules, either one 12 credits module or two 6 credits modules amongst those listed above.

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| ***ASSESSMENT ARRANGEMENTS*** |
|---|
| Formative and summative assessments will be used.<br><br>Formative assessment (Weighs more than Summative Assessment)<br><br>Will include continuous assignments that will collectively contribute to the final grade. Integrated assessment procedures to ensure that the purpose of the qualification is achieved.<br><br>Summative assessment (weighs less than Formative Assessment)<br>There shall be examinations that shall contribute to the final grade. Assessment will be in accordance with respective ETP's regulations and procedures. |
| ***MODERATION ARRANGEMENTS*** |
| **Internal Moderation**<br>Pre-moderation is done by relevant internal structures. Quality assurance of the assessment instruments is conducted prior to administration.<br>**External Moderation**<br>There will also be external moderation. Moderators must be BQA registered and accredited |
| ***RECOGNITION OF PRIOR LEARNING*** |
| There shall be an award of the qualification using Institutional RPL Policy in line with the National RPL Policy. |
| ***CREDIT ACCUMULATION AND TRANSFER*** |
| There shall be access and award of credits of the qualification using Institutional Credit Accumulation and Transfer (CAT) Policy in line with the National CAT Policy. |
| ***PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)*** |
| **Horizontal Progression:** |

- Bachelor's Degree Honours Sciences (geology and engineering geology)

**Vertical Progression:**

- Master's Degree in Science (geology and engineering geology)

**Employment pathway:**

- Geologist.
- Junior Geologist.
- Engineering Geologist.
- Senior. Geologist.
- Environmental Consultant.
- Information Technology (IT) Support Specialist.
- Mine Geologist

## *QUALIFICATION AWARD AND CERTIFICATION*

**Qualification award:**

The students enrolled in the program will be able to obtain a BSc degree in Geology. To obtain the Bachelor of Science in Geology the student must accumulate 522 credits.

**Certification:**

Candidates meeting prescribed requirements will be awarded a **"Bachelor of Science in Geology** in accordance with standards prescribed for the award of the qualification and applicable policies.

## *REGIONAL AND INTERNATIONAL COMPARABILITY*

This qualification has been developed considering the Framework for Higher Education Qualifications (FHEQ) of UK, Geology Society of London regulations accreditation of degrees, UK Quality code for Higher Education in Earth Sciences

This qualification compares favourably with the UK Quality Code for Higher Education in Earth Sciences and the Bachelor of Science Honours Degree in Geology of the University of Portsmouth and meet the requirement for accreditation of Geology degree of Geological Society of London which indicate that curricula must have the following themes embedded:

i) The importance of time and scale in geology, including the 4D investigation of sedimentary sequences, igneous and metamorphic processes and tectonics; the contributions of cognate sciences to geological understanding through geochemistry and geophysics; an understanding of surface processes including those affecting landscape development in the Quaternary; an awareness of the essential contributions of geoscience to the economic, environmental and cultural needs of Society, including a basic understanding of the major ore forming processes.

ii) Essential skills such as practical experience of a range of rocks, structures, landforms etc. in the field, including experience in instrumental and sampling techniques in the field. The ability to describe and identify geological materials and their properties at a range of scales and reach informed conclusions about their possible identity and origin. Visualising geological data in three dimensions, including the construction of cross sections, extraction of 3D orientations from observations on a 2D surface and manipulation of data via stereonets. Exposure to the handling of large data sets using GIS techniques and the use of remote sensing techniques.

iii) Mathematical, statistical and computational skills necessary to understand the quantitative and theoretical aspects of the subject and to handle data sets.

In this regard the proposed qualification covers the same fields of knowledge of the BSc geology offered by the University of Pretoria with the only difference that the BSc Geology at BIUST will run for 4 years instead of 3.

This qualification covers the same spectrum of discipline as the Bachelor of Sccience Geology of the University of Johannesburg. The learning outcomes are the same as the two countries have same need of skilled geoscientist to address economic and environmental issues.

***REVIEW PERIOD***

**Every five (5) years.**

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