SECTION A:	QUALIFICATION DETAILS
QUALIFICATION DEVELOPER (S)	Botswana International University of Science and Technology

TITLE	Doctor of Philosophy in Mining Engineering	**NCQF LEVEL**	10

STRANDS (where applicable)	1. 2. N/A 3. 4.

FIELD	Mining	**SUB-FIELD**	Mining Engineering	**CREDIT VALUE**	360

New Qualification	√	Legacy Qualification	

SUB-FRAMEWORK	General Education		TVET		Higher Education	√

<table>
<tr><td rowspan="3">QUALIFICATION TYPE</td><td>Certificate</td><td>I</td><td></td><td>II</td><td></td><td>III</td><td></td><td>IV</td><td></td><td>V</td><td></td><td>Diploma</td><td></td><td>Bachelor</td><td></td></tr>
<tr><td colspan="3">Bachelor Honours</td><td></td><td colspan="5">Post Graduate Certificate</td><td></td><td colspan="3">Post Graduate Diploma</td><td colspan="2"></td></tr>
<tr><td colspan="7">Masters</td><td></td><td colspan="5">Doctorate/ PhD</td><td colspan="2">√</td></tr>
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RATIONALE AND PURPOSE OF THE QUALIFICATION

RATIONALE:

The mining industry is very vital to the economy of Botswana as it contributes about 19.6% to the GDP (Statistics Botswana, 2023). Currently, there are over 25 operating large-scale mines in Botswana. Accordingly, there is the need to train specialised personnel at PhD level in mining and related programmes to take up jobs in the mining and allied industries.

In the Southern African Development Community (SADC) region, mining is an important strategic sector with significant contributions to gross domestic product, employment, and foreign exchange earnings in many of its member countries. Considering the role of mining sector in SADC and in Botswana's economy, the nation needs mining engineers with specialised technical skills to meet the demands of Botswana, the SADC region and also the international markets.

The rationale of the programme takes into consideration the mission and vision of BIUST, key national strategy and policy documents from HRDC (2023). The relevant occupations on the HRDC report for 2023/24 in the mining and minerals sector include Mineral Economists and Geotechnical Engineers. Specialised technical skills offered by this qualification include mineral policies formulation & applications, mineral accounting & financial modelling, slope stability monitoring, site investigation, mine design and modelling, underground rock mechanics, computer applications. Furthermore, professional University and College Educators are critical in the education and training sector who require technical skills of classroom management, mentoring, subject knowledge and soft skills of supervisory skills and public speaking.

The proposed qualification is set up to serve as one of the key platforms for transforming Botswana's economy (Vision 2036, 2016), from resource-based economy to a knowledge-based economy through skills development in engineering, science, and technology. It also aims at achieving world-class standards in mining engineering education and research; to seamlessly integrate research and education to produce highly skilled mining professionals of international standards and to position Botswana as a knowledge hub by enhancing socio-economic growth through engineering and technological innovations.

A Doctor of Philosophy in Mining Engineering qualifies individuals with most advanced knowledge in mining engineering and produces graduates with most advanced knowledge at the frontier of a specialised discipline or cross-disciplinary fields and can contribute towards development of

professional practice through most advanced research. The graduate will demonstrate a very high level of mastery in mining engineering practices and capacity to retrieve, evaluate, analyse, and interpret information to make propositions and judgments. The graduate will have the capacity to critically analyse and evaluate the existing professional practice and will be able to synthesize and put the issues and ideas in the right perspective. The graduate demonstrates specialised research skills and capacity to develop and apply new skills and techniques to identify and solve problems in mining engineering.

References

HRDC (Human Resources Development Council) (2023). Priority Skills 2023/2024 - Consolidated List of Priority Occupations and Skills. Gaborone, Botswana.

Statistics Botswana (2023). Gross Domestic Product: First Quarter of 2023. Gaborone, Botswana, 21p.

Vision 2036 (2016). Achieving prosperity for all. Prepared by the Vision 2036 Presidential Task Team, Gaborone, Botswana, 42p.

PURPOSE: (itemise exit level outcomes)

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

1. Produce innovative solutions and create new knowledge about Mining Engineering-related problems.
2. Conduct original and advanced research in the areas of Mining Engineering and related fields to advance knowledge in the field.
3. Perform leading roles in addressing societal needs in Mining Engineering and related areas.
4. Exercise high professional standards and integrity in research and professional practice.
5. Lead in Mining Engineering public and private projects to achieve stated goals.

MINIMUM ENTRY REQUIREMENTS (including access and inclusion)

- The minimum admission requirement is a master's degree in mining engineering at NCQF level 9 or a cognate field of study.

- Candidates who do not meet the minimum academic qualifications stated above will be considered through the Recognition of Prior Learning (RPL) process which shall be administered according to the National RPL Policy. There will also be a provision for Credit Accumulation Transfer to the learner in case they transfer in from another institution as per National Policy on CAT.

SECTION B	**QUALIFICATION SPECIFICATION**
GRADUATE PROFILE (LEARNING OUTCOMES)	**ASSESSMENT CRITERIA**
1. Demonstrate the most advanced knowledge in methodologies, principles, and applications of Mining Engineering to address societal challenges.	1.1. Assess the range and limits of the applicability of the core concepts and principles of Mining Engineering. 1.2. Apply the core concepts and principles of Mining Engineering to solve practical societal and industrial problems. 1.3. Analyse and appraise the limitations of most advanced techniques used in Mining Engineering. 1.4. Evaluate the complexity of knowledge and the potential contribution of other interpretations, methods, and disciplines. 1.5. Demonstrate an understanding of how engineering information and ideas become generally accepted for application in mining engineering. 1.6. Conduct research responsibly, consistent with ethical behaviour in line with academic integrity.
2. Conduct independent original and scholarly research in Mining Engineering to advance frontiers	2.1. Demonstrate a conceptual understanding of Mining Engineering and methodological competence and provide reasoned advice to clients.

of knowledge in the discipline of mining engineering.	2.2. Interpret knowledge in Mining Engineering comprehensively and apply the established techniques of research. 2.3. Evaluate current and most advanced research in Mining Engineering and provide reasoned advice to clients. 2.4. Evaluate complex issues and provide judgements based on the established principles and techniques of Mining Engineering. 2.5. Demonstrate originality in the generation and application of knowledge. 2.6. Apply appropriate, most advanced research techniques to collect and analyse data, and produce a scientific document/report for the Mining Engineering audience. 2.7. Discover new ideas through research for the advancement of the field of mining.
3. Apply most advanced knowledge of a wide range of processes to design, analyse and evaluate mining engineering data.	3.1. Apply the existing body of knowledge in the critical analysis of a new question or problem and suggest reasoned solutions. 3.2. Design, select, and apply appropriate procedures for generating relevant information with due concern for bias and any ethical or safety considerations. 3.3. Apply standard procedures such as experimental and computational techniques, within the discipline of Mining Engineering to conduct appropriate forms of enquiry and deductive reasoning. 3.4. Search, collect and record data accurately, truthfully and in appropriate formats. 3.5. Analyse and evaluate data and scientific evidence from which valid arguments and conclusions are presented.

4. Demonstrate professional capabilities, qualities and transferable skills applied in Mining Engineering.	4.1. Demonstrate logical thinking to identify naïve and flawed scientific reasoning. 4.2. Apply scientific knowledge to distinguish inductive and deductive reasoning. 4.3. Evaluate cause-effect relations in the face of uncertainty or gaps in the available information. 4.4. Demonstrate the capacity to judge and solve a complex Mining Engineering problem. 4.5. Demonstrate responsibility and accountability in addressing Mining Engineering related problems. 4.6. Make appropriate decisions in complex Mining Engineering related situations. 4.7. Demonstrate intellectual independence for continuing professional development.
5. Effectively utilise Information and Communication Technology (ICT) skills in solving problems of Mining Engineering.	5.1. Use ICT to record, retrieve and disseminate information to stakeholders. 5.2. Use, develop and modify as appropriate Mining Engineering software packages (geotechnical, mining, exploration, design). 5.3. Apply ICT solutions to design and develop mining, geotechnical, and geophysical models.
6. Communicate scientific knowledge to technical and non-technical people in collaborative Mining Engineering projects.	6.1. Communicate ideas, issues, and findings in written and oral work to diverse audiences. 6.2. Make appropriate referencing conventions, avoid plagiarism, and respect intellectual property rights. 6.3. Contribute effectively and participate actively in the execution of team projects. 6.4. Effectively communicate the outcomes of teamwork concerning each member of the group. 6.5. Take initiative as a member of an Engineering team.

	6.6. Take personal responsibility as a leader in an Engineering team.
7. Use the most advanced Mining Engineering knowledge to address socio-economic problems in an ethical and culturally sensitive manner.	7.1. Apply Mining Engineering knowledge ethically to evaluate complex Mining Engineering problems. 7.2. Critically evaluate public information dealing with current industrial and environmental-related issues. 7.3. Appraise ethically and culturally sensitive decisions on the effects of Mining Engineering-based activities on society. 7.4. Identify and assess the socio-economic impact of interventions in society and industry.
8. Manage learning activities responsibly in Mining Engineering.	8.1. Analyze and synthesize the appropriate study skills. 8.2. Apply effective learning strategies which suit personal needs and context. 8.3. Demonstrate effective time management. 8.4. Apply appropriate analytical skills to design Mining Engineering-related works. 8.5. Apply appropriate skills effectively to organize Mining Engineering-related investigations.
9. Apply the principles of entrepreneurship and innovation in Mining Engineering as tools for driving socio-economic development.	9.1. Define research problems pertinent to society. 9.2. Demonstrate application of Mining Engineering knowledge for the benefit of society in the form of recommendations to policy makers, developing solutions that drive socio-economic development. 9.3. Demonstrate application of the principles underpinning entrepreneurship for the exploitation of product /service/ process opportunities. 9.4. Illustrate models of business innovation and entrepreneurship.

	9.5. Develop comprehensive and well-structured business innovation plans and monitor and evaluate business plans.
10. Apply the most advanced knowledge of design principles in solving mining-related problems.	10.1. Evaluate the design principles that conform to social, legal, health, safety, and environmental standards and regulations. 10.2. Develop briefs and specifications for Mining Engineering projects and generate possible solutions for Mining Engineering problems. 10.3. Evaluate solutions considering possible external factors. 10.4. Solve problems related to Mining Engineering specifications. 10.5. Evaluate the implementation of recommended solutions. 10.6. Apply current practice and appreciate its limitations to possible new developments. 10.7. Apply Mining Engineering techniques in consonance with commercial and industrial constraints.

SECTION C	QUALIFICATION STRUCTURE				
COMPONENT	TITLE	Credits Per Relevant NCQF Level			Total Credits
		Level [ ]	Level [ ]	Level [ ]	
FUNDAMENTAL COMPONENT Subjects/ Courses/ Modules/Units					
	NOT APPLICABLE				
CORE COMPONENT Subjects/Courses/ Modules/Units					
	PhD in Mining Engineering thesis			10	360
STRANDS/ SPECIALIZATION	Subjects/ Courses/ Modules/Units	Credits Per Relevant NCQF Level			Total Credits
		Level [ ]	Level [ ]	Level [ ]	

1.	NOT APPLICABLE				
2.					
Electives	NOT APPLICABLE				

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	**Credit Value**
10	**360**
TOTAL CREDITS	**360**
Rules of Combination: **(Please Indicate combinations for the different constituent components of the qualification)**	
To graduate with a Doctor of Philosophy in Mining Engineering a candidate must attain a minimum total number of 360 credits.	

ASSESSMENT ARRANGEMENTS

All assessments, formative and summative, leading/contributing to the award of credits or qualifications shall be based on learning outcomes and/or sub-outcomes. The assessor must have accreditation from BQA or an equivalent body.

Formative assessment

Formative assessment or continuous assessment should include concept notes, research proposal developments, term papers, seminars, presentations, regular consultation meetings with supervisors, and feedback as well as progress report presentations. Formative assessment is not credited.

Summative assessment

Assessment will be as per the candidate's work that should demonstrate:

1. Significant contribution to knowledge and scholarship.
2. Capacity for original and critical thought.
3. Display an appropriate depth and breadth of knowledge and understanding of the relevant field(s) of study in the thesis and at the viva voce examination.
4. Gained significant expertise concerning basic and advanced/specialized methodologies and techniques.
5. Must have published a minimum number of journal articles, as defined in Faculty regulations, in internationally recognized peer-reviewed journals before submitting the thesis for examination.
6. Oral examination (viva voce) of the thesis material.

Summative assessment is credited and carries 100% weightage (360 credits).

MODERATION ARRANGEMENTS

1. Internal Moderation – Internal moderation is done by internal examiners who are suitably qualified with PhD in Mining Engineering and/ or widely experienced in practice with accreditation from BQA or equivalent body.

2. External Moderation – The final PhD thesis, outcome of the proposed research shall be moderated by External Examiners.

RECOGNITION OF PRIOR LEARNING

Not Applicable, as the PhD in Mining Engineering is purely research-based, and so no prior learning is applicable for gaining credits towards the qualification.

CREDIT ACCUMULATION AND TRANSFER

Credit Accumulation

PhD in Mining Engineering Qualification is based on research only. The credits are calculated based on the successful completion of a thesis. Duration of the PhD in Mining Engineering qualification is three years (6 semesters) minimum and 5 years (10 semesters) maximum for full time and 3 years (6 semesters) minimum and seven years (14 semesters) maximum for part-time program that accumulate to a minimum of 360 credit units, at NCQF level 10.

Credit Transfer

Credits transfer is not applicable for this qualification.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Horizontal articulation:

The qualification is articulated horizontally to:

1. PhD in Civil Engineering
2. PhD in Environmental Engineering
3. PhD in Geological Engineering

Vertical articulation:

Not Applicable

EMPLOYMENT PATHWAYS

The graduates of these qualifications can be employed as:

- Mining Engineer,
- Ventilation Engineer,
- Geotechnical Engineer,
- Mining Inspector,
- Explosives Engineer,
- Drill and Blast Engineer,
- Academicians,
- Researchers.

QUALIFICATION AWARD AND CERTIFICATION

Minimum standards of achievement for the award of the qualification

A candidate is required to achieve pass status for the thesis which is equal to 360 credits. Candidates meeting the prescribed requirements will be awarded the qualification of Doctor of Philosophy in Mining Engineering following standards prescribed for the award of the qualification and applicable policies.

Certification

A certificate for the award of the degree of Doctor of Philosophy in Mining Engineering will be given upon successful completion of the qualification.

SUMMARY OF REGIONAL AND INTERNATIONAL COMPARABILITY

The developed - PhD in Mining Engineering qualification, which is offered by research only, is similar to the qualifications offered by the University of Pretoria, the University of Witwatersrand, South Africa, and the University of New South Wales, Australia. The assessment criteria and award of degree procedures are similar between the developed qualification and those offered by the University of Pretoria, the University of Witwatersrand, and the University of New South Wales. The duration of the developed qualification which is 3 years (Full-time) is like that of the Colorado School of Mines, USA and the University of New South Wales. The eligibility criterion is similar in all cases,

that is, a master's degree in the relevant field of study. The title of the developed qualification is like all the benchmarked qualifications. The credit hours of 360 is similar between the developed and the University of Pretoria, and the University of Witwatersrand.

The developed qualification differs from that of the University of Pretoria and the University of Witwatersrand in terms of duration where the duration for the developed qualification is 3 years while for the benchmarked South African universities it is 2 years. The credit hours differ between the developed qualification and Colorado School of Mines where 360 in the case of the former and 72 in the latter. It also differs from the qualification offered by the University of New South Wales where the latter has 144 credits. Colorado School of Mines' Doctor of Philosophy in Mining Engineering differs from the developed and other benchmarked qualifications in terms of delivery mode where it is coursework with a thesis while the others are only by thesis. The assessment criteria differ between the developed qualification and the qualification offered by the Colorado School of Mines because of the coursework component in the latter.

The NQF level of the developed and the benchmarked qualifications are the same (NQF level 10). All the qualifications are aligned with the Washington Accord. The developed qualification is accredited by the Botswana Qualification Authority (BQA). The qualifications offered by the University of Pretoria - PhD (Mining Engineering) and the University of Witwatersrand Doctor of Philosophy (PhD) in Mining Engineering are approved by the Council on Higher Education (CHE); the qualification offered by Colorado School of Mines - Doctor of Philosophy in Mining Engineering is accredited by Accreditation Board for Engineering and Technology (ABET); the qualification offered by the University of New South Wales is accredited by the Tertiary Education Qualification and Standards Agency (TEQSA). All programs produce graduates who qualify for professional engineering registration by the appropriate boards or organizations in their respective countries.

PhD in Mining Engineering qualification is the highest qualification and there is no vertical progression. There is a scope to pursue post-doctoral research after acquiring PhD degree. But post-doctoral research is not a qualification hence it is not considered as part of vertical progression. Employment pathways include mining engineer, geotechnical engineers, academicians, etc. The qualification is comparable with those it was benchmarked from.

REVIEW PERIOD

Every five (5) years.

For Official Use Only:

CODE (ID)			
REGISTRATION STATUS	**BQA DECISION NO.**	**REGISTRATION START DATE**	**REGISTRATION END DATE**
LAST DATE FOR ENROLMENT		**LAST DATE FOR ACHIEVEMENT**	
REVISION DATE:		**NAME OF PROFESSIONAL BODIES/REGULATORY**	