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QUALIFICATION SPECIFICATION				SECTION A	
QUALIFICATION DEVELOPER	Botswana International University of Science and Technology				
TITLE	Bachelor of Science in Mathematical Sciences		**NCQF LEVEL**		7
FIELD	Natural, Mathematical and Life Sciences		**SUB-FIELD**	Mathematical Sciences	
NEW QUALIFICATION	✓		**REVIEW OF EXISTING QUALIFICATION**		
SUB-FRAMEWORK	General Education		TVET	Higher Education	✓
QUALIFICATION TYPE	Certificate		Diploma	Bachelor	✓
	Bachelor Honours		Master	Doctor	
CREDIT VALUE	528 Credits				

RATIONALE AND PURPOSE OF THE QUALIFICATION

Rationale of the Qualification

Botswana Vision 2036 recognises education and skills development as the foundation for human resource development. The development of the human capital specialised in Mathematical Sciences is essential in achieving the Vision 2036 pillars mainly Pillar 1 (Sustainable Economic Development) and Pillar 2 (Human and Social Development). The two pillars emphasise transformation of Botswana's economy to a knowledge-based economy and producing a globally competitive human resource as a key strategy to drive economic growth and diversification. Mathematical scientists and related professionals and Researchers are some of the national priority occupations as outlined in the Human Resource Development Council (HRDC) report on the areas of Research, Innovation, Science and Technology (HRDC Report 2016). The qualification of Bachelor of Science in Mathematical Sciences is thus in line with its mandate in contribution to the realisation of Vision 2036's National Development Plan 11 (NDP 11).

Stakeholders from various specialised sectors in Botswana have been consulted and remained actively engaged in the design of this qualification. The invaluable input from the industry stakeholders also helped the qualification developers to have an insight on the current and future needs in the areas where graduates of this qualification are required.

Purpose of the Qualification

The specific purpose of this qualification is to produce graduates who have specialized knowledge, skills, and competences to:

- Apply specialized knowledge from mathematical theories, principles, and concepts to solve theoretical and practical problems. Equip learners with entrepreneurial skills which will help them to create jobs for the economy of Botswana and the region.

- Develop computational techniques   using scientific computer languages to solve mathematical problems.

- Demonstrate the ability to gather, evaluate and manage information to produce a scientific document and communicate clearly and effectively to an audience

ENTRY REQUIREMENTS (including access and inclusion)

Minimum entry requirements:

- Certificate IV, NCQF level 4 (BGCSE) or equivalent.

- 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) policies for access.

QUALIFICATION SPECIFICATION	SECTION B
GRADUATE PROFILE (LEARNING OUTCOMES)	**ASSESSMENT CRITERIA**
LO 1. Apply specialized knowledge from mathematical theories, principles, and concepts to solve theoretical and practical problems.	1.1. Utilize core concepts and principles of mathematical reasoning to solve theoretical mathematical problems. 1.2. Determine the limitations of proof techniques used in various mathematical problems. 1.3. Employ mathematical concepts and principles in solving practical problems. 1.4. Conduct supervised research in one of the areas of mathematical sciences.
LO 2. Demonstrate specialized skills to gather, evaluate and manage information to produce a scientific document and communicate clearly and effectively to an audience	1.5. Design and apply appropriate procedures for generating mathematical science information with due concern for bias and for any ethical or safety considerations. 1.6. Examine mathematical information obtained from various resources such as books, journals, internet and other electronic resources to conduct scientific research. 1.7. Analyze mathematical information from a variety of sources, which may be contradictory or divergent to distinguish facts from hypotheses. 1.8. Use appropriate mathematical techniques such as graphical, computational, and deductive reasoning to analyze mathematical information. 1.9. Provide scientific evidence from such analysis with valid arguments and qualitatively assess the validity of arguments presented. 1.10. Establish a system of knowledge in mathematical analysis to produces scientific document. 1.11. Produce oral presentations that communicate Mathematical/Scientific information for the intended audience.

2. Demonstrate specialized key scientific reasoning skills to cross examine logical flow of arguments.	2.1. Determine the ability to judge when appropriate mathematical principles have been used, or a problem has been adequately solved.
3. Develop specialized mathematical approaches to solve real world problems.	3.1. Devise a plan to organize and analyze data by applying advanced mathematical skills to solve both concrete and abstract problems. 3.2. Develop mathematical skills to solve a broad range of real-world problems. 3.3. Construct and assess applications of mathematical concepts. 3.4. Generate innovative solutions to specific problems.
4. Develop computational techniques using scientific computer languages to solve mathematical problems.	4.1. Devise algorithms and implement them to solve problems using mathematical techniques. 4.2. Select appropriate computing tools including computer algebra systems to solve mathematical problems.
5. Organize and manage activities responsibly and effectively.	5.1. Validate appropriate study skills e.g., learning from text, note-taking, summarizing, analyzing and synthesizing information. 5.2. Develop effective learning strategies which suit personal needs and contexts. 5.3. Show effective time management by completing allocated tasks within the set deadlines.
6. Work effectively with others as a member of a team, group, organization and community in scientific projects or investigations.	6.1. Provide evidence of working effectively as a member of a team or group in scientific projects or investigations with significant contribution. 6.2. Outline the key capability to initiate, organize and manage group works.

	6.3.Communicate effectively the outcomes of scientific group work to the relevant audience.
7.Demonstrate specialized knowledge in business communications and entrepreneurship.	7.1.Formulate ideas and/or methods that can be transformed into new products or services. 7.2. Produce written reports that communicate complex disciplinary and interdisciplinary ideas and information effectively for the intended audience and purpose. 7.3. Conduct oral presentations that communicate complex disciplinary and interdisciplinary ideas and information effectively for the intended audience and purpose.

QUALIFICATION STRUCTURE			SECTION C
FUNDAMENTAL COMPONENT	**Title**	**Level**	**Credits**
	Fundamental Component		**102**
Subjects / Units / Modules /Courses	Mathematical Foundations	5	24
	Science Foundations I	5	36
	Computing Foundations	5	12
	Academic Literacy and Social Sciences I	5	12
	Science Foundations II	6	12
	Academic Literacy and Social Sciences II	6	06
CORE COMPONENT	**Core Component**		**378**
Subjects / Units / Modules /Courses	Calculus	6	48
	Mathematical Statistics	6	24
	Algebra I	6	24
	Algebra II	7	36
	Computer Programming	6	30
	Discrete Mathematics	6	12
	Linear Algebra and its Applications	6	24
	Management and Entrepreneurship	7	18
	Differential Equations	7	24
	Probability	7	12
	Work Integrated Learning	7	18
	Analysis	7	48
	Numerical Analysis I	7	12
	Mathematical Modelling	7	12
	Mathematical Biology	7	12
	Project in Industrial Mathematics	7	24
ELECTIVE COMPONENT	**Elective Component**		**48**
	Two Modules (24 credits) from the following		
Subjects / Units / Modules /Courses	Geometry	7	12
	Optimization and Applications	7	12

	Fluid Mechanics	7	12
	Probability and Inference	7	12
	Financial Mathematics	7	12
	Numerical Analysis II	7	12
	Two Modules (24 Credits) from the following		
	Waves and Optics	6	12
	Mechanics & Thermal Physics	6	12
	Electricity and Magnetism	6	12
	Introduction to Organic Chemistry	6	12
	Introduction to Physical Chemistry	6	12
	Cell Biology	6	12
	Genetics	6	12
	Programming in Java	7	12
	Data Structures and Algorithms	7	`12
	Applied Mathematics	7	12

Rules of combinations, Credit distribution (where applicable):

This qualification has 528 credits and takes four years to complete. The credit combination for the qualification is from 102 fundamental components, 378 core components and 48 from elective component distributed to NCQF levels as follows:

Level	Credit Value			
	Fundamental	**Core**	**Elective**	**Total**
Level 5	84	-	-	84
Level 6	18	162	24	204
Level 7	-	216	24	240
Total	102	378	48	528

MODERATION ARRANGEMENTS

ASSESSMENT

All assessments, formative and summative, leading to the award of credits in this qualification shall be based on module learning outcomes, and the qualification exit-level outcomes.

- **Formative Assessment** - A formative assessment aligned to the module learning outcomes and exit-level outcomes will be administered continuously throughout the learning period in each module. The recommended weights of the formative assessment should be at least 50% and should not exceed 60% of the final marks for that module.

- **Summative Assessment** - Learners shall undergo a summative assessment which may include a written examination at the end of learning period in each module. The recommended weights of the summative assessment will vary from 50% to 40% of the final marks for that module. All summative practical assessments must, as far as possible, be conducted in real-work settings.

MODERATION

Pre-assessment moderation will be carried out before administering assessments that contribute towards the award of credits in this qualification and post-assessment moderation will be carried out after the assessment tasks have been marked.

- **Internal Moderation** - Both formative assessment and summative assessment instruments shall be subjected to internal moderation by BQA registered and accredited Assessors and Moderators before administering to ensure fairness, validity, reliability, and consistency of assessments.

- **External Moderation** - Exit level assessment instruments shall be moderated by an External Moderator to ensure fairness, validity, reliability, and consistency of assessments. Qualified external moderators shall be appointed from an accredited Education Training Providers (ETPs).

RECOGNITION OF PRIOR LEARNING (if applicable)

- Recognition of Prior Learning (RPL) will be considered in the award of the qualification in accordance with applicable RPL policy of the ETP which are aligned to BQA/National policies on the same.

- Credit Accumulation and transfer will be awarded in accordance with applicable ETP CAT policies and guidelines which are aligned to BQA/National policies on the same.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Horizontal Articulation:

- Bachelor of Science in Statistics,
- Bachelor of Science in Actuarial Science,
- Bachelor of Science in Financial Mathematics,
- Bachelor of Science in Financial Engineering,
- Bachelor of Science in Industrial Mathematics.

Vertical Articulation

- Master of Science in Financial Mathematics,
- Master of Science in Actuarial Sciences
- Master of Science in Statistics
- Master of Science in Quantitative Finance
- Master of Science in Applied Mathematics
- Master of Science in Pure Mathematics streams.

Employment Pathways:

- Data analyst
- Research scientist in academic and research institutions
- Researcher
- Education Consultant
- Computing (coding, cryptography)

QUALIFICATION AWARD AND CERTIFICATION

Qualification award:

To be awarded the Bachelor of Science in Mathematical Sciences a minimum of 528 credits should be attained.

Certification

Candidates meeting prescribed requirements will be awarded **Bachelor of Science in Mathematical Sciences** and an official transcript.

REGIONAL AND INTERNATIONAL COMPARABILITY

The SAQA Bachelor of Science qualification is at Level 7 and was registered on 1st July 2018. The BSc in Mathematics at the University of Pretoria is recorded against this qualification and comprises of a minimum of 414 credits including 264 credits of core modules. The content includes fundamental mathematics courses (Analysis, Linear Algebra, Abstract Algebra, Geometry) and applied mathematics courses. The assessment of each module is made up of continuous assessment and a final exam.

The Bachelor of Science in Mathematical Sciences at Cardiff University (Wales, United Kingdom) is a three-year degree qualification based on the Framework for Higher Education Qualifications of Degree-Awarding Bodies in England, Wales and Northern Ireland (FHEQ) and is at Level 5 (Foundation degrees) and it is accredited by the Institute of Mathematics and its Applications (IMA). The minimum credits to be awarded a degree is 360. The content includes fundamental mathematics courses (Analysis, Linear Algebra, Abstract Algebra, Geometry) and applied mathematics courses. For the assessment, the examination carries 100% of marks in most modules.

The Bachelor of Science in Mathematics at the Australian National University is at Level 7 of the Australian Qualification Framework (AQF). The duration of the qualification is three (3) years. It comprises a minimum of 144 units. Full-time students normally undertake 24 units of courses each semester. This is comparable to the minimum of 60 credits in NCQF credit system. The content includes Mathematics and Applications, Analysis, Algebra, Topology, Mathematical Modeling, Computational Mathematics and Applied Mathematical Modeling.

All the three qualifications compare very well to our proposed Bachelor of Science in Mathematical Sciences in terms of learning outcomes, topics covered, and the number of credits or units. There is a difference in the duration and number of credits of our qualification as an extra year is needed to bring learners close to A-level.

REVIEW PERIOD

Every five (5) years.