BQA NCQF QUALIFICATION TEMPLATE

SECTION A:	QUALIFICATION DETAILS				
QUALIFICATION DEVELOPER (S)	Botswana International University of Science and Technology				
TITLE	Master of Science in Biotechnology			**NCQF LEVEL**	9
STRANDS (where applicable)	N/A				
FIELD	12: Natural, Mathematical and Life Sciences	**SUB-FIELD**	Biological Sciences	**CREDIT VALUE**	240

New Qualification	✓	*Legacy 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:

Botswana has a rich biodiversity which can be used to produce goods and services for the benefit of its society. Biotechnology is a promising technology for sustainable utilization of this biological diversity for application in agriculture, industry, health care, and environmental protection. Societies around the world are already reaping immense benefits from advancements in biotechnology in the sectors of health care, agriculture, industry, and environment. The major applications include diversity of bio-based new products and services, like disease-resistant plants, natural pesticides, environmental remediation technologies, biodegradable plastics, novel therapeutic agents and pharmaceuticals, and chemicals and enzymes that reduce the cost of industrial processes as in textile, food and beverage, and energy and mining industries. To use the full potential of biotechnology, it is important to develop human resources capacity for biotechnology research, development, and entrepreneurship. The existing biotechnology capacity in Botswana are limited both in scope and number. Biotechnology must be strengthened in the country not only to assimilate the progress made in the world but also to undertake research for solving own specific problems. This would be possible only by producing well-trained scientific manpower in the country. It is therefore urgently required that well- planned postgraduate programs in biotechnology are incorporated in the higher education system. Thus, the MSc in Biotechnology Program at the Department of Biological Sciences and Biotechnology can contribute to national capacity building by bridging this gap.

Biotechnology is a highly interdisciplinary field in life sciences that has tremendously contributed to the development of various economic sectors such as agriculture, health care, industry, and environment of many countries of the world. Hence, the need for biotechnologists with advanced knowledge and demonstrate high level of mastery, innovation, autonomy, scholarly and professional integrity in the various economic sectors of Botswana cannot be overemphasized. The Human Resources Development Council (HRDC) (2015, 2019) report has identified the lack of qualified personnel in specialized disciplines, as one of the bottlenecks to the implementation of government policies and development projects. Accordingly, life science professionals including medical practitioners, nurses, laboratory technicians, veterinarians and agricultures scientists, research scientists and molecular biotechnologists. These skilled and competent personnel require a higher level of training at masters and PhD levels to provide evidence-based policy reforms for the agriculture sector (HRDC, 2015, 2019).

The MSc degree in Biotechnology offers unparalleled opportunities for internationalization. As such, the degree structure is strategically designed to foster international, regional, and local collaboration among institutions engaged in teaching and research to better utilize Botswana's biological resources using modern biotechnologies.

PURPOSE: (itemise exit level outcomes)

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

- Develop solutions for complex and unpredictable environmental and ecological problems.
- Deliver clear and coherent written and oral information about biotechnology in scientific documents, reports, and presentations to address solving agricultural, environmental, industrial, and medical biotechnological issues.
- Generate cutting-edge technologies in all fields of biotechnology.
- Utilize modern tools of biotechnology to Implement Botswana's domestic sustainable development goal of 'Protect, restore and promote sustainable use of terrestrial ecosystems.
- Manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity losses''.
- Conduct applied research in various areas of modern biotechnology to promote inventory of Botswana biodiversity and facilitate the identification of bioproducts of medical and economic importance.

MINIMUM ENTRY REQUIREMENTS (including access and inclusion)

To be admitted in the Master of Science in Biotechnology Program, the applicant must have a

- Bachelor of Science (BSc) degree (NCQF Level 7 in the same or a cognate field of study.

- Entry through RPL is provided for.

SECTION B	*QUALIFICATION SPECIFICATION*
GRADUATE PROFILE (LEARNING OUTCOMES)	***ASSESSMENT CRITERIA***
3.1 Demonstrate advanced knowledge and skills in the major fields of biotechnology to apply the principles in solving societal problems.	3.1.1 Identify researchable problem, formulate hypothesis, and develop research proposals. 3.1.2 Design field and laboratory experiments. 3.1.3 Collect data and analyze and interpret the research data concisely. 3.1.4 Communicate research findings through different platforms and media.
3.2 Demonstrate advanced skills in biotechnology methods in solving complex and unpredicted problems in biotechnology	3.2.1 Identify and analyze different scientific procedures about a research problem in biotechnology. 3.2.2 Select appropriate methods and tools for analysing research data. 3.2.3 Synthesize biotechnology literature and data and communicate the research information in scientific publications, conferences, and other platforms
3.3 Demonstrate advanced skills in communicating Biotechnological information	3.3.1 Apply advanced knowledge in Biotechnology when articulating information.

	3.3.2 Synthesize Biotechnological information into clear and succinct scientific publications. 3.3.3 Use highly appropriate referencing conventions in written communications, avoiding plagiarism and demonstrating a high level of respect for intellectual property. 3.3.4 Use appropriate scientific language to deliver clear and coherent written (and oral) information about Biotechnology in scientific documents, reports, and presentations.
3.4 Exhibit advanced entrepreneurial and business skills in developing and manage biotechnology business projects	3.4.1 Undertake market research to identify a market gap for biotechnology products. 3.4.2. Devise a business plan for biotechnology-based business. 3.4.3 Analyze value chain for biotechnology products and services. 3.4.4 Develop marketable bio-based products and services from bio-resources.
3.5 Demonstrate advanced knowledge and awareness of bioethics when undertaking tasks in Biotechnology.	3.5.1 Handle biological specimens in an ethically and culturally sensitive manner and within the legislative framework while undertaking experiments in Biotechnology. 3.5.2 Avoid violation of intellectual property rights and show mutual respect to other scientists while undertaking research activities in Biotechnology.

	3.5.3 Apply strict ethical practices and safety measures when handling, using, and modifying biological systems. 3.5.4 Demonstrate high ethical and cultural sensitivity when disseminating scientific findings in Biotechnology. 3.5.5 Make high ethically and culturally sensitive decisions on the effects of Biotechnology based activities.

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SECTION C	***QUALIFICATION STRUCTURE***				
COMPONENT	***TITLE***	***Credits Per Relevant NCQF Level***			***Total Credits***
		Level [ ]	***Level [ ]***	***Level [ ]***	
FUNDAMENTAL COMPONENT	***N/A***				

Subjects/ Courses/ Modules/Units					
CORE COMPONENT *Subjects/Courses/ Modules/Units*	MSc Research project			***168***	***168***
	Advanced Microbiology			***12***	***12***
	Advanced Cell and Molecular Biology			***12***	***12***
	Applied Bioinformatics			***12***	***12***
STRANDS/ SPECIALIZATION	*Subjects/ Courses/ Modules/Units*	***Credits Per Relevant NCQF Level***			***Total Credits***
		Level [ ]	***Level [ ]***	***Level [ ]***	
1.					
	N/A				

2.					
Electives	Applied Animal Biotechnology			***12***	***12***
	Medical Biotechnology			***12***	***12***
	Microbial Fermentation Technology			***12***	***12***
	Waste Treatment and Valorization			***12***	***12***
	Emerging Technologies			***12***	***12***

	Biosafety and Intellectual Property Rights			***12***	***12***

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	*Credit Value*
9	*240*
TOTAL CREDITS	*240*
Rules of Combination: ***(Please Indicate combinations for the different constituent components of the qualification)***	
Core level 9 = 216, 168 (MSc Research Project) + 48 (Core Modules) **Electives level 9 =** 24 credits (student choose two modules) **Total =** 240 credits	

ASSESSMENT ARRANGEMENTS
Assessment for this qualification will be done by both Formative and Summative methods as follows: Formative assessment = 40% Summative assessment = 60% Assessment should be undertaken by suitably qualified persons in biotechnology accredited by BQA.
MODERATION ARRANGEMENTS
There will be provision for both internal and external moderation and examination as quality assurance measure in accordance with institutional policies aligned with national policies. Moderation shall be done by suitably qualified persons in biotechnology accredited by BQA.
RECOGNITION OF PRIOR LEARNING
Applicants who have obtained other qualifications and have relevant experience may be considered through Recognition of Prior Learning (RPL) and the arrangement for RPL will be in accordance with institutional Policies in line with the National RPL Policy.
CREDIT ACCUMULATION AND TRANSFER
Credit accumulation and transfer will be in accordance with the Credit Accumulation and Transfer (CAT) policies for access. This consideration will be done following Institutional policies which are aligned with BQA/National policies.
PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)
Learning Pathways 1. Vertical articulation (NCQF Level): • Doctorate in Biotechnology • Doctorate in Molecular Biotechnology • Doctorate in Molecular Biology

- Doctorate in Bioinformatics

2. Horizontal articulation (NCQF Level):

- Master of Science in Biology
- Master of Science in Microbiology
- Master of Science in Genetics
- Master of Science in Crop Science
- Master of Science in Agriculture
- Master of Science in Animal Science
- Master of Science in Medical Technology

3. Employment progression pathways:

- Research Scientist
- Laboratory technician
- Laboratory manager
- Biosafety Regulator
- Diagnostician
- Bioprocess technologist
- Bioproduct developer

QUALIFICATION AWARD AND CERTIFICATION

Qualification Award

Candidate to graduate with a Master of Science in Biotechnology Degree should:

• have presented research proposal before a panel of judges

• have passed the thesis

• have passed thesis defense seminar

• have attained 240 credits.

Certification: There shall be an award of Master of Science Degree in Biology upon successful completion of the qualification along with transcripts

SUMMARY OF REGIONAL AND INTERNATIONAL COMPARABILITY

Extensive regional and international comparability was conducted with various countries from different continents. The universities chosen were the University of Pretoria (South Africa), Master of Science in Biotechnology; Australian National University (Australia), Master of Science in Biotechnology and Uppsala University (Sweden), and Master of Science in Biotechnology. The Universities were chosen because of their best practices in academia and their high rankings in the world scale. There are no universities that offer this qualification nationally. Aspects of the qualification that were compared include the qualification name, the duration of study, the credit load, the qualification structure, and entry requirements. The University of Pretoria offers a research-based one year MSc degree of 180 credits to students who already have BSc (Honours) degree in Biotechnology or related areas; The Uppsala University offers a two-year MSc degree of 120 credits comprising of advanced courses; and Australian National University offers a two-year MSc degree of 120 credits comprising of advanced courses. Both Uppsala University and Australian National University offers module including molecular biology, biochemistry, bioinformatics, biotechnology, chemistry, medical technology/informatics, pharmacy, or biophysics. Our MSc degree will be a two-year degree of 240 credits and will consist of both advanced courses and research.

Master of Biotechnology is not offered in any institution in Botswana. therefore, the Master of Biotechnology will provide a pathway for science graduates with background knowledge in biochemistry, bioinformatics, biotechnology, microbiology, and molecular biology to acquire new knowledge, or extend and update theoretical and practical understanding of modern Biotechnology.
Pathway includes:

- Completing an MSc in Biotechnology with both taught and research components can lead to a PhD in: Animal Science, Biotechnology, Biological Sciences, Bioinformatics, Genetics, Molecular Biology, Microbiology and Plant Science.

- This program prepares the scientist to carry out research in basic, medical, or agricultural sciences in university, industry, and government research institutions. Opportunities exist in scientific, pharmaceutical and pathology companies, or in government, private and public service positions.

REVIEW PERIOD
This qualification will be reviewed after 5 years or as and when the need arises.

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**	