# BQA NCQF QUALIFICATION TEMPLATE

| SECTION A: | QUALIFICATION DETAILS | | |
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| **QUALIFICATION DEVELOPER (S)** | Botswana International University of Science and Technology | | |
| **TITLE** | Bachelor of Science (Honours) in Biotechnology | **NCQF LEVEL** | 8 |
| **STRANDS (where applicable)** | N/A | | |
| **FIELD** | Natural, Mathematical and Life Sciences | **CREDIT VALUE** | 126 |
| **SUB FIELD** | Biological Sciences | | |

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| New Qualification | ✓ | Legacy Qualification | | Renewal Qualification | |
| | | | | Registration Code | |

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| **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

### 1.1. Rationale of the Qualification

Botswana indigenous people have always harbored knowledge of using organisms such as plants, micro-organisms and animals for their benefit. Recently, Botswana has been dependent on natural resources, mainly diamonds. These minerals have contributed immensely to economic growth in the country; however, they will eventually get depleted. In that case, Botswana will need an alternative source of economic sustenance and growth. The country is shifting from a resource-based to a knowledge-based economy. To achieve this, Botswana will have to tap into the indigenous knowledge generated over generations or generate new knowledge through scientific studies, research or

entrepreneurship. One of the highly rich and opportune areas recently to develop knowledge is research through Biotechnology.

Apart from minerals, Botswana is known for its success in conservation of its biodiversity. The biological diversity has been another significant source of income for the country, especially in the form of tourism. Biodiversity can also be a source of knowledge through different studies, including Biotechnology. In recent times, there is great economic potential in genetic diversity, in addition to the diversity in morphology of the biodiversity. Exploring genetic diversity could be one of the areas in which biotechnology may be important for Botswana, if capacity is built in this discipline. It can help us diversify how we benefit from our biodiversity. Documents like the National Development Plan (NDP11), National Biodiversity Strategy and Action Plan (NBSAP) and the Fifth National Report to the Convention of Biological Diversity have already indicated the need for capacity building in the management of national biodiversity. There is also need for capacity building in Botswana for the fulfilment of national obligations to the globe such as the Nagoya Protocol on Access and Benefit Sharing, United Nations Convention of Combating Desertification, RAMSAR convention on Wetlands of International Importance; United Nations Sustainable Development Framework (UNSDF); World Bank Programme, Wealth Accounting and Valuation of Ecosystem Services (WAVES), Convention of Biological Diversity (CBD) and the Cartagena Protocol on Biosafety.

Botswana could benefit from application of highly specialized knowledge, methodologies and skills in Biotechnology. These are important towards the improvement of product development, problem solving and innovations in agriculture, industry, environmental management, medicine and other Biotechnology related fields. They are also very important in research in these fields, which is deficient in Botswana. Sustainable exploration and management of biological resources is a critical area of the sciences and is an excellent choice for students wishing to pursue a career in highly specialized scientific research, in industry and the private sector. This Honours course offers students the opportunity to receive highly specialized expert research-informed and involved teaching in a variety of core topics specifically relevant to the biotechnological applications. The students will learn how to apply a theoretical scientific knowledge base to highly specialized active research areas that address contemporary challenges and will develop practical skills by undertaking a significant amount of individual research work. The project will impart practical skills and provide an element of high specialization. Topics that are important to Botswana and the region will be emphasized, however the programme will also include global issues. Projects will allow students to retrieve data from multiple

sources, synthesize and use it to design research projects, acquire data and solve environmental problems. They will then acquire skills in research design, data interpretation, presentation and reporting. This will allow them to understand the current status of knowledge in Biotechnology. The graduates will have undergone attachments which will have trained them teamwork and provide the skills necessary for them to fit into the real world working environment. In addition, Botswana could benefit from capacity building, policy development and regulation in many different areas of Biotechnology. Five obvious gaps that need to be urgently addressed are in the areas of industrial, plant, animal, environmental and medical biotechnology. Biotechnology graduates that could benefit Botswana should have knowledge and skills in these five main areas of Biotechnology.

Most of researchers in Botswana hold Bachelors/Masters degrees as opposed to Doctorate degrees (DRST 2009). There is therefore need to upgrade Bachelors to Honours, Masters and PhD levels. This will boost the country's research potential and skill in terms of knowledge and manpower. During the National Development Plan (NDP) 11 the Botswana Government will continue to grow the economy through beneficiation of various biological products (agricultural and indigenous products / herbs). The proposed Qualification will help to diversify the economy as there is potential for growth in the manufacturing industry using biological samples. For example Botswana as a cattle country has potential for mass production of vaccines, diagnostic kits, industrial enzymes, biotechnology-based environmental solutions, new pharmaceuticals, improved crops and animals e.t.c.

### 1.2. Purpose of the Qualification

**PURPOSE: (itemise exit level outcomes)**

The purpose of this qualification is to produce graduates with highly specialized knowledge, skills and competence to:

1. Obtain and use biotechnological data to solve problems in agriculture, industry, conservation, environment, medicine e.tc.
2. Promote sustainable biotechnological practices to alleviate poverty, achieve food security, and combat effects of climate change.
3. Develop solutions to waste management problems to achieve sustainable cities.

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| 4. Conduct basic research to inform solutions to biotechnological challenges such product development, environmental pollution, conservation, disease diagnostics and treatment. |
| **MINIMUM ENTRY REQUIREMENTS (including access and inclusion)** |
| • Minimum entry qualification is Bachelor degree, NCQF Level 7.<br>• 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. This consideration will be done following guidelines of the ETP in line with BQA/National policies. |

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| **QUALIFICATION SPECIFICATION**<br>**SECTION B** | |
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| **GRADUATE PROFILE (LEARNING OUTCOMES)** | **ASSESSMENT CRITERIA** |
| 1. Demonstrate highly specialized knowledge of biotechnological concepts in plant, animal, industrial, medical and environmental biotechnology | 1.1. Apply biotechnological concepts in the research involved in product development, management and modification of biological systems<br>1.2. Suggest solutions in the different areas of Biotechnology.<br>1.3. Suggest methodologies and techniques to carry out different processes and tasks of Biotechnology |
| 2. | 2.1. Critique, analyze and modify the quality of data derived from a variety of sources which may be contradictory or divergent relating to applications, methodologies and techniques applied to solving biotechnology-related problems |
| 3. Conduct basic research in biotechnology to solve biotechnology problems | 3.1. Design highly specialized appropriate research for generating specific data in Biotechnology with due concern for bias and for any ethical and safety considerations.<br>3.2. Execute specialized research appropriately using specialized procedures in biotechnology |

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| | 3.3. Record and integrate data accurately and truthfully and in appropriate formats.<br>3.4. Critique data and scientific evidence and from such analysis valid highly specialized arguments and conclusions are presented |
| 4. Develop, construct and manage a research project in biotechnology | 4.1. Develop efficient and achievable Biotechnology projects and programs for undertaking in ways that are ethical and are within the regulatory framework<br>4.2. Use biological and biotechnological resources in a responsible manner<br>4.3. Management time effectively when undertaking biotechnological projects<br>4.4. Evaluate whether a problem has been adequately solved using the biotechnological approaches |
| 5. Reflect and analyze project results critically and independently. | 5.1. Select appropriate methods and format for recording project data in biotechnology<br>5.2. Use highly appropriate tools and methods to analyse biotechnological data<br>5.3. Use appropriate formats to display and present data from biotechnological projects<br>5.4. Interpret data from biotechnological and scientific projects correctly and discuss the findings appropriately |
| 6. Communicate convincing and reasoned scientific arguments at a level and style appropriate to the audience and to report scientific findings in an oral and substantial written format | 6.1. Use appropriate scientific language to deliver clear and coherent written (and oral) information about Biotechnology in scientific documents, reports and presentations<br>6.2. Communicate effectively research findings, orally and in written form, through diverse platforms, including online platforms<br>6.3. Use appropriate referencing conventions in written communications, avoiding plagiarism and demonstrating high level of respect for intellectual property |

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| 7. Work on an advanced biotechnological and scientific activity both autonomously and collaboratively | 7.1. Provide evidence of successful and effective contributions in group work for solving Biotechnology-related and scientific problems.<br>7.2. Communicate the outcomes of biotechnology project group work effectively and with respect for the contributions of each group member.<br>7.3. Apply organizational skills in managing group work in biotechnological projects |
| 8. Apply ethical awareness, professional practice and awareness of the relationship between biotechnology when dealing its role in society | 8.1. Handle biological and biotechnological specimens in a highly safe, ethical and culturally sensitive manner and within the legislative framework while undertaking experiments in Biotechnology<br>8.2. Apply strict ethical practices and safety measures when handling, using, and modifying biological systems<br>8.3. Demonstrate high ethical and cultural sensitivity when disseminating scientific findings in Biotechnology<br>8.4. 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 [ 8 ] | |
| **FUNDAMENTAL COMPONENT** Subjects/ Courses/ Modules/Units | | | | | |
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| **CORE COMPONENT** Subjects/Courses/ Modules/Units | Honors Project in Biotechnology I | | | 18 | 18 |
| | Current Topics & Seminar in Biotechnology | | | 6 | 6 |
| | Advanced Bioinformatics | | | 12 | 12 |
| | Biosafety and Biosecurity | | | 6 | 6 |
| | Honours Project in Biotechnology II | | | 60 | 60 |
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| STRANDS/ SPECIALIZATION | Subjects/ Courses/ Modules/Units | Credits Per Relevant NCQF Level | | | Total Credits |
|---|---|---|---|---|---|
| | | Level [ ] | Level [ ] | Level [ 8 ] | |
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| Electives | Epigenetics | | | 12 | 12 |
| | Molecular Pharming | | | 12 | 12 |
| | Bioremediation | | | 12 | 12 |
| | Natural Products; Secondary Metabolites | | | 12 | 12 |
| | Drug Design and Discovery | | | 12 | 12 |
| | Microbial Fermentation Technology | | | 12 | 12 |
| | Cellular Basis of Disease | | | 12 | 12 |
| | Microbial Drug Resistance Mechanisms | | | 12 | 12 |
| | Cancer Biology | | | 12 | 12 |
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| SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL | |
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| **TOTAL CREDITS PER NCQF LEVEL** | |
| **NCQF Level** | **Credit Value** |
| **8** | **126** |
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| **TOTAL CREDITS** | **126** |

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

Fundamentals Level 8 - 0 Credits
Core Level 8 - 102 Credits
Electives Level 8 - 24 Credits
Total 126 Credits

Learners Choose 2 electives worth 24 Credits

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**ASSESSMENT ARRANGEMENTS**

**Formative Assessment**

All formative assessments shall be aligned to learning outcomes. Formative assessment will contribute 50% towards final grade.

**Summative Assessment**

Summative assessment will contribute 50% of the final grade. Assessors must be BQA registered and accredited.

Assessment must be conducted by suitably qualified persons preferably with a masters degree in the area of biotechnology.

**MODERATION ARRANGEMENTS**

There will be internal and external moderation for the qualification. Moderators must be BQA registered and accredited. Both internal and external moderation will be done in-line with institutional and national policies.

**RECOGNITION OF PRIOR LEARNING**

Candidates may submit evidence of prior learning and current competence and/or undergo appropriate forms of RPL assessment for the award of credits towards the qualification in accordance with applicable RPL policies and relevant national-level policy and legislative framework.

**CREDIT ACCUMULATION AND TRANSFER**

There is provision for award of credits through CAT in line with ETP policies.

**PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)**

**Horizontal Progression**

• Bachelor of Science (Honours) in Evolutionary Biology and Ecology
• Bachelor of Science (Honours) in Biology

**Vertical progression**

- Master of Science in Biotechnology
- Master of Science in Evolutionary Biology and Ecology

**Employment Pathways**

- Analytical biochemist
- Biomedical scientist
- Healthcare scientist
- Clinical biochemist
- Industrial enzymologist
- Life science research scientist
- Plant and Animal breeder
- Stem Cell Technologist

## QUALIFICATION AWARD AND CERTIFICATION

### Qualification Award

A candidate will be awarded a qualification in Bachelor of Science (Honours) Biotechnology upon meeting the minimum of 126 credits as prescribed in the rules of combination.

### Certification

A certificate and transcript will be issued to graduates upon successful completion of the qualification.

## SUMMARY OF REGIONAL AND INTERNATIONAL COMPARABILITY

**Regional Comparison**: Bachelor of Science (Honors) in Biotechnology – University of Pretoria, South Africa

**International Comparison**: Bachelor of Biotechnology (Honours), University of Newcastle, Australia.

**Titles**: The title for this qualification is the same as those of the benchmarks as indicated above.

**NQF Levels:** This qualification is on NCQF level 8, which is equivalent to the regional and international benchmarks; AQF (Australia) and NQF Level (South Africa).

**Credits**: There is some difference in credits of the benchmarks with this qualification at 126 being closest to the south African qualification 135. This qualification meets the minimum credits for NCQF Level 8 qualifications which is 120 credits.

**Exit Level outcomes:** The exit levels outcomes are similar in that they empathize basic research and application of highly specialised knowledge, skills and competence in various aspects of biotechnology

Main Modules:

**Assessment:** . A weighted average of at least 60% at final-year level is required. For the South African qualification which is similar to this qualification. Assessment weightings for the Australian qualification were not provided.

**Learning and employment pathways:** all the qualifications offer learners similar learning pathways as they progress vertically to masters degrees in Biotechnology related fields. Further, the qualifications offer similar occupational opportunities in terms of careers and possible places of work.

| **REVIEW PERIOD** |
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| 5 Years in line with the NCQF. |

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**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** | |
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