BQA NCQF QUALIFICATION TEMPLATE

SECTION A:	QUALIFICATION DETAILS		
QUALIFICATION DEVELOPER (S)	Botswana International University of Science and Technology		
TITLE	Bachelor of Science in Astronomy	**NCQF LEVEL**	7
FIELD	Natural, Mathematical and Life Sciences	**CREDIT VALUE**	480
SUB FIELD	Physical Sciences		

New Qualification	X	Legacy Qualification		Renewal Qualification	
				Registration Code	

SUB-FRAMEWORK	General Education		TVET		Higher Education	X									
QUALIFICATION TYPE	Certificate	I		II		III		IV		V		Diploma		Bachelor	X
	Bachelor Honours		Post Graduate Certificate		Post Graduate Diploma										
	Masters		Doctorate/ PhD												

RATIONALE AND PURPOSE OF THE QUALIFICATION

RATIONALE:

The Botswana Vision 2036 emphasizes education and skills development as essential for economic progress. In line with this, tertiary institutions are tasked with providing citizens quality academic, technical, and vocational skills to build a globally competitive knowledge-based economy. Science, technology, and innovation are seen as critical drivers of this transformation. The Bachelor of Science in Astronomy degree aligns with Vision 2036 and the National Development Plan (NDP 11), addressing a national shortage of professionals in Physics and related fields. Reports from Botswana's Human Resource Development Council and South Africa's Department of Higher Education highlight this shortage.

Botswana is actively involved in international projects like the Square Kilometer Array (SKA), HIRAX, and the African VLBI Network, which enhances its role in astronomy. The new degree combines coursework and research, equipping graduates with advanced knowledge and problem-solving skills applicable in diverse fields, including technology, defence, and finance. Additionally, the program emphasizes hands-on learning, fostering employability and entrepreneurship. Graduates will contribute to transforming Botswana from a resource-based to a knowledge-based economy, as

envisioned in Vision 2036 and NDP 11, through their roles in research, industry, and policy-making, ensuring long-term economic and industrial growth.

PURPOSE: (itemise exit level outcomes)

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

1. Apply methods of inquiry and established codes of practice and capacity for critical analysis and interpretation of information in Astronomy.
2. Apply a range of technical processes and skills to generate solutions to unpredictable and complex Astronomy problems.
3. Solve problems and manage processes within Astronomy for specified activities and work outputs by carrying out processes that require the use of specialized basic and applied research skills.
4. Communicate complex findings to the professional community and the public by effectively translating technical or specialized information into accessible language.
5. Apply critical thinking skills to the current state of knowledge, formulate hypotheses, design experiments and interpret results.

MINIMUM ENTRY REQUIREMENTS (including access and inclusion)

Minimum entry requirements:

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

SECTION B	QUALIFICATION SPECIFICATION
GRADUATE PROFILE (LEARNING OUTCOMES)	***ASSESSMENT CRITERIA***
1. Apply systematic, extensive, and comparative knowledge to solve problems in Astronomy using the concepts and principles of Physics, Mathematics, Astronomy and Data Science.	1.1. Identify the relationships among the core concepts and principles of Astronomy. 1.2. Assess the range and limits of the applicability of the core concepts and principles of Astronomy. 1.3. Determine core concepts and principles of Astronomy to solve practical societal and industrial problems. 1.4. Analyse and appraise the limitations of basic techniques used in Astronomy. 1.5. Recognise and assess the significance of contested scientific knowledge in a contemporary context. 1.6. Establish how scientific information and ideas become generally accepted.
2. Analyze scientific information in Astronomy by examining observational data, theoretical models, and simulations to interpret phenomena occurring in the universe	2.1. Access information through the library, internet and other data storage and retrieved facilities. 2.2. Employ scientific reasoning to evaluate the quality of information. 2.3. Synthesise information from a variety of sources, which may be contradictory or divergent. 2.4. Utilize the acquired knowledge to interpret phenomena occurring in the universe
3. Generate scientific information in Astronomy by designing and conducting observations, experiments, or simulations to gather new data about the cosmos.	3.1. Select appropriate procedures for generating relevant information with due concern for bias and any ethical or safety considerations. 3.2. Collect and record data accurately, truthfully and in appropriate formats. 3.3. Apply standard procedures within the discipline of Astronomy to conduct appropriate forms on enquiry.
4. Demonstrate advanced technical key scientific reasoning and problem solving in Astronomy.	4.1 Identity naïve and flawed scientific reasoning. 4.2 Distinguish between inductive and deductive reasoning. 4.3 Apply hypothetical and deductive reasoning. 4.4 Detect cause-effect relations in the face of some level of uncertainty or gap in available information. 4.5 Establish the self-conscious capacity to judge when understanding has been achieved or a problem has been adequately solved.
5. Communicate scientific understanding in Astronomy, both verbally and in writing,	

using visual, symbolic, and/or other forms of representation.	5.1. Produce clear and coherent written documents, which follow appropriate scientific conventions. 5.2. Present scientific information verbally to scientific and non-scientific audiences. 5.3. Employ appropriate referencing conventions, avoid plagiarism, and respect intellectual property. 5.4. Use non-verbal forms of representation correctly and appropriately.
6. Solve scientific and industrial problems in Astronomy by applying astrophysical technological solutions to address challenges faced in both research and industry	6.1. Analyse concrete and abstract problems, in familiar and unfamiliar contexts. 6.2. Apply the knowledge of theory to solve real-world contexts. 6.3. Integrate knowledge from various subjects and disciplines in solving scientific and industrial problems
7. Demonstrate effective information and communication technology (ICT) and programming skills in Astronomy by utilizing data processing tools to collect, analyse, and visualize astronomical data.	7.1. Employ tasks related to basic computer literacy skills. 7.2. Assess the validity of ICT solutions for problems posed by Astronomy as a discipline. 7.3. Utilise ICT that is appropriate to Astronomy as a discipline for simulations and computational applications. 7.4. Acquire the ability to code in e.g. Python.
8. Work effectively as a member of a team or group in scientific projects and investigations in Astronomy.	8.1. Demonstrate evidence of successful and effective contributions in group work is provided. 8.2. Communicate the outcomes of a scientific group work while respecting the contributions of each group member. 8.3. Use organisational skills in managing group work.
9. Apply scientific methods and knowledge in Astronomy to solve problems in society and industry, considering ethical and cultural issues.	9.1. Apply scientific knowledge that is relevant to current societal and industrial issues. 9.2. Evaluate public information dealing with current scientifically related issues. 9.3. Appraise ethically and culturally sensitive decisions on the effects of scientifically based activities on society. 9.4. Assess the socio-economic impact of scientific interventions in society and industry. 9.5. Show that scientific knowledge is applied for the direct benefit of society and to drive socio-economic development through industrialization.
10. Apply the principles of innovation in Astronomy as tools for driving socio-economic development.	10.1 Present an understanding of the principles underpinning innovation for the exploitation of

	products/services/processes so that opportunities are understood and applied. 10.2 Illustrate models of innovation. 10.3 Develop comprehensive and well-structured innovation plans.

SECTION C	***QUALIFICATION STRUCTURE***				
COMPONENT	***TITLE***	***Credits Per Relevant NCQF Level***			***Total Credits***
		Level [5]	***Level [6]***	***Level [7]***	
FUNDAMENTAL COMPONENT *Subjects/ Courses/ Modules/Units*	Mathematics	24			24
	Chemistry I	12			12
	Academic Literacy and Social Sciences I	12			12
	Foundations of Physics I	12			12
	Computer Science	06			06
	Biology I	12			12
	Subtotal (Level 5)				**78**
CORE COMPONENT *Subjects/Courses/ Modules/Units*	Astronomy I		12		12
	Chemistry II		12		12
	Biology II		12		12
	Foundations of Physics II		48		48
	Applications of Physics I		12		12
	Physics Laboratory and Computation I		12		12
	Mathematical Methods I		84		84
	Academic Literacy and Social Sciences II		12		12

	Subtotal (Level 6)				**204**
	Astronomy II			48	48
	Foundations of Physics III			48	48
	Applications of Physics II			36	36
	Physics Laboratory and Computation II			12	12
	Mathematical Methods II			12	12
	Work Integrated Learning			42	42
	Subtotal (Level 7)				**198**
	Total				**480**

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	**Credit Value**
5	78
6	204
7	198
TOTAL CREDITS	**480**

Rules of Combination:

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

The Bachelor of Science in Astronomy constitutes a minimum total number of 480 credits which are distributed as follows (based on the above Qualification Structure) with respect to different university and NCQF levels:

- NCQF Level 5 - number of credits is 78
- NCQF Level 6 - number of credits is 204
- NCQF Level 7 -number of credits is 198
- Elective modules need to be chosen at the appropriate NCQF Level (in consultation with the Department of Physics and Astronomy) subject to the pre-requisite requirements.

ASSESSMENT ARRANGEMENTS

- Formative assessment shall be 50%
- Summative assessment 50% of the final marks

MODERATION ARRANGEMENTS

There shall be provision for both internal and external moderation by qualified moderators and assessors.

RECOGNITION OF PRIOR LEARNING

Recognition of Prior Learning (RPL) will be considered in the award of the Bachelor Science in Astronomy qualification in accordance with existing RPL policies.

CREDIT ACCUMULATION AND TRANSFER

There shall be provision for an award through Credit Accumulation and Transfer (CAT) in accordance with CAT policies.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Horizontal articulation:

- Bachelor of Science (Applied Physics)
- Bachelor of Science (Physics)
- Bachelor of Science (Applied Mathematics)
- Bachelor of Science (Engineering Physics)

Vertical articulation:

- Bachelor of Science Honours (Astronomy)
- Bachelor of Science Honours (Physics)
- Bachelor of Science (Applied Mathematics)
- Bachelor of Science (Engineering Physics)

Employment

Employment pathways include:

- Research Associate/Scientist
- Optical Physicist
- Telescope Operator
- Software Developer
- Data Scientist
- Energy Physicist
- Space Physicist.

QUALIFICATION AWARD AND CERTIFICATION

Qualification award:

Candidate(s) will be awarded the degree of Bachelor of Science in Astronomy after attaining the stipulated minimum credits of 480 as specified in the rules of combination and credit distribution.

Certification:

Candidates meeting prescribed requirements will be awarded the qualification in accordance with standards prescribed for the award of the qualification and applicable policies. A certificate of the award of Bachelor of Science in Astronomy will be given upon successful completion of the qualification.

SUMMARY OF REGIONAL AND INTERNATIONAL COMPARABILITY

We have compared our proposed BSc in Astronomy to four similar offerings, one in South Africa, one in Europe, one in North America and one in Australia.

1. University of the Witwatersrand in South Africa offers a 3-year BSc in Astronomy and Astrophysics
2. Liverpool University in the UK offers a 3-year BSc in Astronomy and Astrophysics.
3. The Australian National University offers at 3-year BSc with a Major in Astronomy and Astrophysics
4. The University of Arizona, USA, offers a 4-year BSc with a Major in Astronomy.

Similarities

- The developed BSc Astronomy qualification has also been benchmarked relative to the Graduate Skills Base of Institute of Physics in the UK, and hence our qualification is very similar to the above degree (University of Liverpool) in terms of the exit level outcomes, domains covered, delivery and assessments methods, education and employment pathways.
- Developed qualification is very similar to the ANU qualification in terms of the exit level outcomes, domains covered, methods, education and employment pathways, industrial internships (work-integrated learning), and the inclusion of applications of physics.
- Developed qualification is very similar to the qualification at the University of Arizona in terms of the exit level outcomes, domains covered, methods, education and employment pathways, industrial internships (work-integrated learning), and the inclusion of applications of physics.
- Finally, developed qualification compares well with the one at Wits University in South Africa. and is similar to the general outcomes drawn for South African institutions.

Differences

- Because of Botswana's First Year Bachelor course structure, leaners will be required to take courses in Chemistry and Biology, something that is not required in these other BSc degrees.
- In the developed qualification leaners will also do "Academic Literacy and Social Sciences" courses in at both Level 5 and Level 6
- In the developed qualification leaners will be required to do a Work Integrated Learning (WIL) module during their 3rd year.

The developed qualification articulates well with the qualifications it was benchmarked against with exit level outcomes and key modules aligning well. This makes the developed qualification to vertically and horizontally articulate well within regional and international education landscapes as the qualifications are comparable. Graduates of the developed qualification are also marketable

regionally and international due to the alignment and parity with the qualifications it was benchmarked against and market needs.

In conclusion, the developed BSc in Astronomy compares well with similar qualifications in the region, and internationally, whilst retaining some of the unique features of the Higher Educational experience that Botswana has to offer.

REVIEW PERIOD
The review period of the qualification shall be 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**	