SECTION A:	***QUALIFICATION DETAILS***																	
QUALIFICATION DEVELOPER (S)	Botswana International University of Science and Technology																	
TITLE	Bachelor of Science in Applied Physics													***NCQF LEVEL***		7		
FIELD	Natural, Mathematical and Life Sciences		***SUB-FIELD***		Applied Physics									***CREDIT VALUE***		*480*		
New Qualification						✓	*Review of Existing 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:

The Botswana Vision 2036 recognizes education and skills development as a foundation for human resource development. In accordance with the Botswana Vision 2036 Pillar 1 and Pillar 2, tertiary education providers are mandated to provide quality training opportunities for the increasing number of school leavers. A qualification in Bachelor of Science in Applied Physics was informed by this mandate in contribution to the realization of Vision 2036's National Development Plan (NDP11). This qualification is also supported by the Tertiary Education Policy, as approved by the National Assembly (2008:10).

In December 2016, the HRDC published a report that indicates Botswana is currently experiencing a shortage of human capital in Physics and related fields. The shortage of Physicists is not only being experienced in Botswana. The Department of Higher Education and Training of South Africa 2014 published a report titled "Skills for and through Strategic Infrastructure Projects" and lists Physicist as one of the scarce human

resources in the country. This report outlined the processes that have been followed to identify the scares skills for strategic infrastructure projects and steps that need to be taken if the projected scarcity is to be addressed. Thus, considering this scarcity of human resources in Physics and related fields, this qualification is thus designed to equip graduates with the required skills and competencies to prepare them to fill the shortage gaps identified in these reports and this is in line with the national priorities as outlined in the Vision 2026 NDP 11.

PURPOSE:

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

- Solve scientific and industrial problems in Applied Physics.
- Resolve complex and interdisciplinary problems of local importance and global relevance in diverse scientific and non-scientific professions.
- Create new scientific knowledge in Applied Physics through supervised research projects.
- Apply scientific methods and knowledge in the area of Applied Physics to solve problems in society and industry, considering ethical and cultural issues.
- Apply the principles of entrepreneurship and innovation in Applied Physics as tools for driving socio-economic development.

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***
LO 1. Apply systematic, extensive, and comparative knowledge to solve Applied Physics problems using the concepts and principles of Physics.	1.1. Identify the relationships among the core concepts and principles of Applied Physics. 1.2. Assess the range and limits of the applicability of the core concepts and principles of Applied Physics. 1.3. Determine core concepts and principles of Applied Physics to solve practical societal and industrial problems. 1.4. Analyse and appraise the limitations of basic techniques used in Applied Physics. 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.
LO 2. Demonstrate specialized knowledge, in analysing scientific information in Applied Physics.	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.
LO 3. Generate scientific information in Applied Physics.	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 Applied Physics to conduct appropriate forms on enquiry.

	3.4 Analyse and evaluate data and scientific evidence from which valid arguments and conclusions are presented.
LO 4. Demonstrate advanced technical key scientific reasoning in Applied Physics.	4.1 Identity naïve and flawed scientific reasoning. 4.2 Distinguish between inductive and deductive reasoning. 4.3 Apply hypothetico-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.
LO 5. Communicate scientific understanding in Applied Physics, 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.
LO 6. Solve scientific and industrial problems in Applied Physics.	6.1 Analyse concrete and abstract problems, in familiar and unfamiliar contexts. 6.2 Use the knowledge of theory to real-world contexts. 6.3 Integrate knowledge from various subjects and disciplines in solving scientific and industrial problems.
LO 7. Demonstrate effective information and communication technology (ICT) skills in Applied Physics.	7.1 Employ tasks related to basic computer literacy skills. 7.2 Assess the validity of ICT solutions for problems posed by Applied Physics as a discipline. 7.3 Utilize ICT that is appropriate to Applied Physics as a discipline for simulations and computational applications,

	pattern recognition, automation, and control, and managing large volumes of data.
LO 8. Work effectively as a member of a team or group in scientific projects and investigations in Applied Physics.	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.
LO 9. Apply scientific methods and knowledge in Applied Physics 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.
LO 10. Design, manage, and organise learning activities responsibly in Applied Physics.	10.1 Assess appropriate study skills (learning from text, note-taking, summarising, analysis, and synthesis). 10.2 Ensure effective learning strategies which suite personal needs and context are developed and applied. 10.3 Exhibit effective time management.
LO 11. Apply the principles of entrepreneurship and innovation in Applied Physics as tools for driving socio-economic development.	11.1 Present understanding of the principles underpinning entrepreneurship for the exploitation of product/service/process opportunities are understood and applied. 11.2 Illustrate models of business innovation and entrepreneurship. 11.3 Develop comprehensive and well-structured business 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	36			36
	Chemistry	24			24
	Academic Literacy and Social Sciences	12			12
	Physics	48			48
CORE COMPONENT *Subjects/Courses/ Modules/Units*	Foundations of Physics	48			48
	Mathematical Methods	36			36
	Experimental and Computational Physics	12			12
	Academic Literacy and Social Sciences	6			6
	Foundations of Physics		60		60
	Applications of Physics		12		12
	Experimental and Computational Physics		12		12
	Mathematical Methods		12		12
	Foundations of Physics			24	24
	Applications of Physics			24	24

	Experimental and Computational Physics			12	12
	Work-integrated Learning			36	36
ELECTIVE/ OPTIONAL COMPONENT *Subjects/Courses/ Modules/Units*	Physics for Earth and Environmental Sciences		***12***		***12***
	Introduction to Financial Accounting		***12***		***12***
	Introduction to Entrepreneurship		***6***		***6***
	Bayesian Statistics and Decision Theory		***12***		***12***
	Management and Entrepreneurship Concepts and Principles			***6***	***6***
	Mathematical Programming and Game Theory			***12***	***12***
	Developing a Strategic Business Plan			***6***	***6***

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	***Credit Value***
Level 5	222
Level 6	138
Level 7	120
TOTAL CREDITS	480

Rules of Combination:

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

The Bachelor of Science in Applied Physics 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 222
- NCQF Level 6 -number of credits is 138
- NCQF Level 7 -number of credits is 120

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

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 and summative assessments will be used.

Formative assessment (Weighs more than Summative Assessment)

• The weighting for formative assessment will 60%.

Formative Assessment will include continuous assignments that will collectively contribute to the final grade. Integrated assessment procedures to ensure that the purpose of the qualification is achieved.

Summative assessment (weighs less than Formative Assessment)

• The weighting for summative assessment will 40%.

There shall be examinations that shall contribute to the final grade. Assessment will be in accordance with respective ETP's regulations and procedures.

Assessors must be BQA registered and accredited.

MODERATION ARRANGEMENTS

Internal Moderation:

Pre-moderation is done by relevant internal structures. Quality assurance of the assessment instruments is conducted prior to administration.

External Moderation:

There will also be external moderation.

Moderators must be BQA registered and accredited

RECOGNITION OF PRIOR LEARNING

Recognition of Prior Learning (RPL) shall be granted where the candidate is able to provide sufficient evidence of their competence in a module or set learning outcomes as determined by the appointed RPL Assessor(s).

CREDIT ACCUMULATION AND TRANSFER

Credit transfer will be awarded in accordance with applicable CAT policies and guidelines. After meeting all the requirements of the course, the candidate will be awarded the BSc (Honours) in Applied Physics qualification through both the RPL and CAT route.

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 (Applied Physics)

• Bachelor of Science Honours (Physics),

• Bachelor of Science (Applied Mathematics),

• Bachelor of Science (Engineering Physics),

However, this will be subject to meeting the relevant prerequisites subject to meeting the relevant prerequisites, by research or course work at recognised higher education providers in the region and the around world.

Employment

Employment pathways include:

• Laser Physicist,

• Research Associate/Scientist,

• Optical Physicist,

• Design Physicist,

• Software Developer,

• Nuclear Physicist,

• Meteorologist,

• Patent Attorney,

• Energy Physicist,

- Space Physicist,
- Environment and Climate Physicist.
- Nanotechnologist and Data Analyst.

QUALIFICATION AWARD AND CERTIFICATION

Qualification award:

Candidate(s) will be awarded the degree of Bachelor of Science Applied Physics 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 Applied Physics will be given upon successful completion of the qualification.

REGIONAL AND INTERNATIONAL COMPARABILITY

This Bachelor of Science in Applied Physics qualification is compliant with and conforms to the Subject Benchmark Statement for Physics published by the Quality Assurance Agency for Higher Education in the United Kingdom and complies with the Benchmark Statement for Physics in South Africa. Furthermore, the exit-level outcomes of the qualification are consistent with the Level Descriptors for the South African National Qualifications Framework. In addition, the skills, achievements, and knowledge of subject matter that are expected from graduates of an accredited Bachelor of Science in Applied Physics degree are aligned with those published4 by the Institute of Physics in the United Kingdom.

The Bachelor of Science in Applied Physics qualification of the education provider has been benchmarked against a sample of similar qualifications offered within the region [BSc Applied Physics Qualification offered by the University of Johannesburg (South Africa)] and abroad [Applied Physics BSc (Hons) offered by the University of Dundee (Scotland); BSc (Hons) Applied Physics Qualification offered by the Universiti Teknologi Petronas (Malaysia); BSc (Honours) in Applied Physics Qualification offered by the Nanyang Technological University (Singapore).

1. University of Dundee (Scotland) – Applied Physics BSc (Hons) Qualification

The University of Dundee (Scotland) offers a four-year Applied Physics BSc (Hons) 5 qualification, accredited by the UK Institute of Physics.

comparability with proposed qualification:

Our BSc Honours Applied Physics 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 in terms of the exit level outcomes, domains covered, delivery and assessments methods education and employment

pathways, one of the differences being that the qualification from the University of Dundee is a four-year degree whereas our degree spans five years. An added advantaged of our qualification is a stronger focus on Computational Physics, High Performance Computing and Big Data analytics, and Non-Linear Dynamics and Complex Systems, which are areas in high demand by industry. Furthermore, our qualification includes a dedicated semester for work-integrated learning (not included in the learning qualification at the University of Dundee), where students gain real life work experience in collaboration with research groups, research institutions, technology parks, business incubators, and physics-based industries in the region and around the world.

Compared to the University of Dundee, our qualification also includes a larger variety of non-science modules for equipping learners with knowledge and practical skills in: Technical Writing and Academic Literacy; Technical Report Writing; Professional Communication; Technical Communication and Basic Research Methods; Introduction to Entrepreneurship; Management and Entrepreneurship Concepts and Principles; Project Management; Starting and Sustaining a Business; Economics, Business and Entrepreneurship; Developing a Strategic Business Plan; Risk Management; Introduction to Accounting and Finance; Innovation, Commercialisation and Intellectual Property; Organisational and Leadership Management. The latter modules equip students with much-needed soft-skills that are required by industry and business.

2. Universiti Teknologi Petronas (Malaysia) – BSc (Hons) Applied Physics Qualification

The Universiti Teknologi Petronas (Malaysia) offers a four-year BSc (Hons) Applied Physics qualification which is accredited by the Malaysian Qualification Agency.

comparability with proposed qualification:

Our qualification is very similar to the above qualification in terms of the exit level outcomes, domains covered, methods, education and employment pathways, industrial internships (work-integrated learning), and non-science courses in technical communication and business. An added advantaged of our qualification is a stronger focus of Computational Physics, High Performance Computing and Big Data analytics, and Non-Linear Dynamics and Complex Systems, which are areas in high demand by industry. Furthermore, our qualification offers a five specialization tracks compared to the three specialization areas offered by the Universiti Teknologi Petronas.

3. Nanyang Technological University (Singapore) – BSc (Honours) in Applied Physics Qualification

The Nanyang Technological University (Singapore) offers a four-year BSc (Honours) Applied Physics8 qualification.

comparability with proposed qualification:

Our qualification is very similar to the above qualification in terms of the exit level outcomes, domains covered, methods, education and employment pathways and non-science courses. The Final Year Project and Professional Internship are regarded as elective modules. An added advantaged of our qualification is a stronger focus of Computational Physics, High Performance Computing and Big Data analytics, and Non-Linear Dynamics and Complex Systems, which are areas in high demand by industry. Furthermore, our

qualification offers a five specialization tracks compared to the three specialization areas offered by the Nanyang Technological University. Furthermore, our qualification includes both a final year research project and work-integrated learning, whereas Nanyang Technological University includes either a final year research project or work-integrated learning.

4. University of Johannesburg (South Africa)

comparability with proposed qualification:

Our BSc Applied Physics qualification has also been benchmarked relative to the Level Descriptors for the South African National Qualifications Framework, and hence our qualification is very similar to the above degree in terms of the exit level outcomes, domains covered, delivery and assessments methods, education, and employment pathways. An added advantaged of our qualification is the compulsory nature of a Research Project and Work-integrated Learning, both of which are considered as electives at the Nanyang Technological University, and a stronger focus of Computational Physics, High Performance Computing and Big Data analytics, and Non-Linear Dynamics and Complex Systems, which are areas in high demand by industry. Furthermore, our qualification offers a five specialization tracks compared to the three specialization areas offered by the University of Johannesburg.

REVIEW PERIOD

Every five years (5).