| SECTION A: | QUALIFICATION DETAILS | | | | |
|---|---|---|---|---|---|
| QUALIFICATION DEVELOPER | UNIVERSITY OF BOTSWANA | | | | |
| TITLE | Bachelor of science (Physics) | | | NCQF LEVEL | 7 |
| FIELD | Natural, Mathematical and Life Sciences | SUB-FIELD | Physics | CREDIT VALUE | 496 |
| 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 National Policy on Research, Science, Technology and Innovation (RSTI) represents Botswana's commitment to diversify her economy, attain global competitiveness, and enhance the quality of life of Batswana. This is to be achieved through the development, adaptation and application of research, innovation, and technology to produce products and services using local resources. Research, innovation, and development will continue to be critical factors in creating and sustaining national competitive advantage and economic growth during NDP 11. Physics is the foundation in any science related research, whether in geosciences, theoretical, experimental, weather forecasting and space related research and hence the demand in physics graduates. One of the pillars of vision 2036 is that sustainable and optimal use of natural resources will have transformed our economy and uplifted our people's livelihoods. The use of science research (physics in particular) has the potential to innovate and create employment skilled, unskilled and semi-skilled segment of the population and thereby improve their quality of life. Physics through research has the capability of developing new technologies that can be utilized to protect the environment and minimize the severity of global warming and through science new frontiers in research can be developed.

The ETSSP: (2015-2020) strategies will have far-reaching effects and flexible lifelong learning opportunities by providing high quality education thus fostering innovation and generating new knowledge and skills for the socio-economic and sustainable development of the nation through research and education. The Bachelor of Science (Physics) qualification provide excellence in the delivery of learning to ensure society is provided with talented, creative, and confident graduates with advanced knowledge and skills. Application of physics-dependent knowledge and technology is important to the development of a society through the application of research, technologies, innovation, and development, hence the need to have graduates in physics who could be absorbed by different scientific, engineering and related fields which requires physics as a foundation.

**PURPOSE:**

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

i) Conduct scientific surveys, investigations and analyse various data types.

ii) Demonstrate knowledge and understanding in applying scientific rationale to explain laws and theories which enables us to comprehend how things interact in nature of matter.

iii) Evaluate and synthesise qualitative and quantitative data interpretations.

iv) Provide solutions to key issues facing society such as engineering, renewable energy generation, communication, development of new materials, transport and vehicle safety, medical science, an understanding of climate change, and mineral technology.

***ENTRY REQUIREMENTS (including access and inclusion)***

**Minimum entry requirements:**

i. Certificate NCQF level 4 (General Education or TVET)

ii. RPL according to University Policy

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| ***SECTION B*** | ***QUALIFICATION SPECIFICATION*** |
|---|---|
| ***GRADUATE PROFILE (LEARNING OUTCOMES)*** | ***ASSESSMENT CRITERIA*** |

| | |
|---|---|
| LO1: Apply critical reasoning skills and specialised knowledge to solve physics and related problems. | 1.1 Identify core theories and principles of physics.<br>1.2 Identify physical laws relevant to solving physics problems.<br>1.3 Use appropriate knowledge to solve physics theoretical concepts.<br>1.4 Use appropriate laboratory skills for experimental investigations.<br>1.5 Analyze results obtained from laboratory investigations. |
| LO2: Develop communication skills for transfer of scientific information to the community. | 2.1 Use computers, videos, and online resources to engage and reinforce understanding on various physics fields.<br>2.2 Defend oral and poster presentations in conference and class settings.<br>2.3 Conduct a research project and share results with relevant stakeholders. |
| LO3: Apply fundamental physics principles and mathematical concepts in science related problems. | 3.1 Use fundamental physics principles for solving problems.<br>3.2 Write scientific reports and articles for sharing scientific information.<br>3.3 Apply mathematical and computational techniques in solving problems<br>3.4 Solve complex physics problems using mathematics and physics concepts. |

| | |
|---|---|
| LO4: Distinguish between qualitative and quantitative scientific data. | 4.1 Solve physics problems that deal with non-numerical data sets.<br>4.2 Use appropriate technology, computational and mathematical tools to manipulate numerical data or information that can be converted into numbers.<br>4.3 Present scientific data by graphing and making use of computer plotting tools. |
| LO5: Illustrate skills to apply appropriate methodologies for a given research problem. | 5.1 Develop a basic study design in physics or related area.<br>5.2 Implement study design and monitor the experiment.<br>5.3. Process collected scientific data, to provide a meaningful recommendation. |

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| SECTION C | QUALIFICATION STRUCTURE | | | | | |
|---|---|---|---|---|---|---|
| | TITLE | Credits Per Relevant NCQF Level | | | | Total (Per Subject/ Course/ Module/ Units) |
| | | Level [5] | Level [6] | Level [7] | Level [8] | |
| FUNDAMENTAL COMPONENTS *Subjects/ Courses/ Modules/Units* | Communications and Study Skills | 16 | | | | 16 |
| | Computing and information Skills | 12 | | | | 12 |
| CORE COMPONENTS *Subjects/ Courses/ Modules/Units* | Geometrical Optics and Mechanics | 12 | | | | 12 |
| | Electricity, Magnetism and Elements of Modern Physics | 12 | | | | 12 |
| | Science based courses (Courses from Chemistry, Biology and Mathematics within the faculty of science) | 44 | 48 | 32 | 32 | 156 |
| | Mechanics, Vibrations and Waves, Physical Optics | | 12 | | | 12 |
| | Properties of Matter, Basic Thermodynamics, and Introduction to Nuclear Physics | | 12 | | | 12 |
| | Advanced Electricity and Magnetism | | 12 | | | 12 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Basic Electronics | | 12 | | | 12 |
| | Advanced Mechanics | | | 12 | | 12 |
| | Introduction to Quantum Mechanics | | | 12 | | 12 |
| | Advanced Electronics | | | 12 | | 12 |
| | Introduction Electromagnetism | | | 12 | | 12 |
| | Analytical Thermodynamics | | | 12 | | 12 |
| | Vibrations, Waves and Advanced Physical Optics | | | 12 | | 12 |
| | Statistical Mechanics | | | | 12 | 12 |
| | Solid State Physics | | | | 12 | 12 |
| | Project in Physics | | | | 12 | 12 |
| | Physics Practical | | 8 | 8 | 8 | 24 |
| | Atomic and Basic Nuclear Physics | | | | 12 | 12 |
| | Advanced Solid-State Physics | | | | 12 | 12 |
| | Microcomputing for Physical Sciences | | | | 12 | 12 |
| | Optional/Electives | | 24 | 24 | 24 | 72 |

| | | | | | | |
|---|---|---|---|---|---|---|
| ***ELECTIVE/OPTIONAL COMPONENTS*** *Subjects/ Courses/ Modules/Units* | Mathematical Methods for Physical Sciences | | 12 | 12 | | 24 |
| | Basic Potential Fields in Geophysics | | 12 | | | 12 |
| | Special Relativity | | 12 | | | 12 |
| | Vibrations, Waves and Advanced Physical Optics | | 12 | | | 12 |
| | Advanced Electronics | | 12 | | | 12 |
| | Physics of the Environment | | 12 | | | 12 |
| | Elements of Air Pollution | | 12 | 12 | | 24 |
| | Physics of Renewable Energy | | | 12 | | 12 |
| | Microprocessor and Digital Systems | | | 12 | | 12 |
| | Microcomputing for Physical Sciences | | | 12 | | 12 |
| | Basic Seismology | | | 12 | | 12 |
| | Introduction to Astrophysics | | | 12 | | 12 |
| | Project in Physics | | | 12 | | 12 |
| | Advanced Mechanics | | | 12 | | 12 |
| | Introduction to Quantum Mechanics | | | 12 | | 12 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Physics Practical | | | 18 | | 18 |
| | Introduction to Electromagnetism | | | 12 | | 12 |
| | Analytical Thermodynamics | | | 12 | | 12 |
| | ***BQA Credit for BSc degree program:*** 496 | | | | | |

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| ***SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL*** | |
|---|---|
| ***TOTAL CREDITS PER NCQF LEVEL*** | |
| ***NCQF Level*** | ***Credit Value*** |
| 5 | 96 |
| 6 | 128 |
| 7 | 136 |
| 8 | 136 |
| ***TOTAL CREDITS*** | 496 |

***Rules of Combination:***

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

| | **Bachelor of Science (Physics)** |
|---|---|
| Fundamentals | 28 |
| Core | 240 |
| Optional/electives | 72 |
| Science based courses (courses from Chemistry, Biology and | 156 |

| | | |
|---|---|---|
| Mathematics within the faculty of science) | | |
| **Total credits** | 496 | |
| Optional/electives (72 credits minimum)<br>Minimum electives = 24 credits<br>Minimum optional courses = 48 credits | | |

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| ***ASSESSMENT ARRANGEMENTS*** |
|---|
| Formative assessment and summative assessment are based on learning outcomes and contribute 50% each towards the final grade. |
| ***MODERATION ARRANGEMENTS*** |
| Moderation to be done following university regulations and by BQA registered assessors and moderators. |
| ***RECOGNITION OF PRIOR LEARNING (if applicable)*** |
| Prior learning assessment for candidates are carried out to conform to assessment principles in line with BQA policy and university regulations. |
| ***PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)*** |
| **Vertical progression**: Candidates may progress to:<br>a) Post-Graduate Diploma or Post-Graduate Certificate in Education (NCQF level 8)<br>b) Bachelor of Science (honors) (NCQF level 8)<br>c) Master of Science Degree in Physics (NCQF level 9)<br>d) Master of philosophy in Physics NCQF level 9).<br><br>**Horizontal progression: candidate may progress to:** Candidates may venture into specialized Bachelor of Science degree qualifications such as: |

a) Bachelor of Science (Physics with meteorology): NCQF level 7
b) Bachelor of Science (Radiation and health physics): NCQF level 7
c) Bachelor of Science (Applied geophysics): NCQF level 7
d) Information Technology, Agriculture, Engineering, laboratory technicians. and construction engineering Bachelor qualifications offered at NCQF level 7.

**EMPLOYMENT OPPORTUNITIES FOR PROGRAMME GRADUATES:**

- Geophysicist/field seismologist
- Higher education lecturer
- Metallurgist
- Nanotechnologist
- Radiation protection practitioner
- Research scientist (physical sciences)
- Secondary school teacher
- Meteorologist
- Engineer (nuclear, software, laser, nanotechnology, telecommunications, optics)
- Astrophysicist
- Medicine practitioner
- Consultants in Renewable energy
- Agricultural engineer.

## *QUALIFICATION AWARD AND CERTIFICATION*

Candidates meeting the prescribed requirements (minimum credits of 496 as per NCQF level 7) will be awarded the Bachelor of Science (Physics) qualification in accordance with the qualification composition rules and applicable policies.

## *REGIONAL AND INTERNATIONAL COMPARABILITY*

The proposed qualification is comparable to some international universities in terms of course content, exit level outcomes, assessment criteria and education and employment pathways. The qualification allows for both vertical and horizontal articulation in the academic progression pathway. The proposed 4-year BSc degree program has 496 credits. The credits are generally higher than regional and international universities offering BSc (physics) at NCQF level 7. The other notable difference observed is that some

universities offer BSc (Honors) NCQF level 8 at much lower credits e.g. University of Venda, and University of Johannesburg. The proposed qualification is similar in structure to qualifications offered at University of Manchester, UK (4-year BSc degree program, accredited by Institute of physics (IOP): UCAS Code F300) and University of Sussex; (Physics BSc Honours, Duration:4 years full time; UCAS code: FF35). The qualifications at these universities are offered at 480 credits. The exception is Newcastle University, which offers Physics BSc Hons: UCAS Code: F300 as a 3-year fulltime program. Interns of NCQF levels, this qualification, it is similar to BSc qualification at University of Venda in terms of structure.

***REVIEW PERIOD***

Qualification to be reviewed every 5 years.

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