BOTSWANA Qualifications Authority

**BQA NCQF Qualification Template**

**DNCQF.FDMD.GD04** **Issue No.: 01**

| **QUALIFICATION SPECIFICATION** | | | | | | | | **SECTION A** |
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| **QUALIFICATION DEVELOPER** | Botswana University of Agriculture and Natural Resources | | | | | | | |
| **TITLE** | Doctor of Philosophy in Food Science | | | | **NCQF LEVEL** | | 10 | |
| **FIELD** | Agriculture and Nature Conservation | | **SUB-FIELD** | Food Science | | | | |
| New qualification | √ | | Review of existing qualification | | | | | |
| **SUB-FRAMEWORK** | General Education | | TVET | | Higher Education | √ | | |
| **QUALIFICATION TYPE** | Certificate | | Diploma | | Bachelor | | | |
| | Bachelor Honours | | Master | | Doctor | √ | | |
| **CREDIT VALUE** | 360 | | | | | | | |

**RATIONALE AND PURPOSE OF THE QUALIFICATION**

**Rationale**

In Botswana, there is no Doctor of Philosophy (PhD) qualification in Food Science (HRDC, 2018). As a result, the country is spending exorbitant amounts of foreign currency to educate its citizens in foreign Institutions. Improvement of agriculture productivity is one of the prime priorities in the economic diversification policy of Botswana (Director General, 2008). Agricultural productivity can be sustainably realized if only supported by value addition practices which involves the input of knowledge, skills and technology across the value chains of each agricultural food produce to minimize losses (quantity and quality), overcome food safety and nutrition deficiency challenges, food security problems and to become competitive in the global food markets. High level qualified manpower at PhD level is a key step for the development of food science professionals and expansion of innovative research for the transformation of the agri-food sectors. Such graduates will serve as leaders in postharvest sector, agro-processing industry, human nutrition and food safety as well as in the tertiary education system of Botswana. These graduates will support the use of plant and animal food resources of Botswana in an effective manner, so that it can be competitive. Thus, there is a need for qualified personnel equipped with advanced knowledge, skills and competencies at PhD level in the area of Food Science who will play a leading role in higher learning institutions, research centers, food industries and Government for the advancement of the food sectors in Botswana and the region.

A needs assessment survey was conducted from June 2013 to February 2014 by distributing questionnaires to different stakeholders from the Government, non-Government and private sectors. stakeholders showed that 90% of the respondents supported MSc qualification in Food Science and Technology, 70% supported PhD qualification in Food Science and 30% supported MPhil in Food Science. Higher learning institutions, research centers and Government organizations indicated the need for a PhD qualification in Food Science that will produce graduates who will play a leading role in education, research, strategies and policy development.

Furthermore, the knowledge, skills and competencies required from the postgraduate qualification as indicated by the stakeholders include: Infant and young child feeding; Cereal science and technology; Meat science; Food microbiology; Biotechnology; Thermal processing; Extrusion processing; Biochemistry; Nutrition; Food science; Food processing; Food preservation; Food Product development; Education and communication skills; Food packaging; Food value chains; Food quality control; Postharvest handling and quality management; Processing of fruits and vegetables; Hazard Analysis Critical Control Points (HACCP), Good Hygiene Practices (GHP) & Good Manufacturing Practice (GMP); Food regulation and standards and Water quality and treatments.

The respondents indicated that the research and development activities conducted by postgraduate students should focus on the following areas: sorghum and its products; mycotoxins control; meat processing and preservation, meat quality evaluation, factors affecting meat (beef) quality in Botswana; hygiene standards in the meat industry for the export market; novel food product development, indigenous foods; sensory evaluation; functional foods; food processing and preservation; food engineering; genetically modified organisms; product shelf life; postharvest losses in Botswana; quality and safety standards of foods; packaging materials and cold chain management; processing of fruits and vegetables; manufacturing efficiencies; food adulteration; consumer awareness on quality issues of foods; microbiology and chemical residues in foods; waste water management; food and nutrition security; child development and nutrition; nutritional status of Batswana; nutritional analysis of school diets and traditional foods.

**Purpose**

The purpose of this qualification is to:

- train food scientists who will play a leading role in research, academia, outreach services and the advancement of the food.
- train qualified graduates to lead the agro-processing industry and other food sectors to ensure. effective use of resources for sustainable development.
- develop highly skilled graduates who will serve in the academia and research establishments.
- train graduates capable of designing and formulating strategies and policies on issues of food sectors in the various Government Ministries.
- produce graduates who can design, plan and execute cutting-edge research projects and generate innovative technology for the food sector.
- produce graduates capable of generating and advocating policies on extension and community engagement on issues of food safety, nutrition, and food security

## ENTRY REQUIREMENTS (including access and inclusion)

**Minimum entry requirement for this qualification is a:**
Master's degree, NCQF level 9 or equivalent.

**Recognition of Prior Learning (RPL):**
There will be access through Recognition of Prior Learning (RPL) and Credit Accumulation and Transfer (CAT) in accordance with the RPL and CAT National Policies.

| QUALIFICATION SECTION B | SPECIFICATION |
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| **GRADUATE PROFILE (LEARNING OUTCOMES) At the end of PhD training in Food Science, graduates should be able to:** | **ASSESSMENT CRITERIA Formative and summative assessment will be used.** |
| • Develop and present seminar in specific food science topic to wider audience, | • In specific food science topic learners identified relevant scientific literatures, critically reviewed and synthesized information,<br>• Write scientific seminar that are linguistically, technically and scientifically correct,<br>• Demonstrated progress made, identified research gaps, future recommendations, correctly cited and listed bibliographically on references used,<br>• Able to present critically reviewed scientific seminar to panel of expert and/or wider audience. |
| • Design and conduct basic and/or applied, innovative independent research in the area of food science and related fields, | • In specific food science area, able to conceive research topic, write research proposal, formulate research problem (s) /question (s), objective (s),<br>• Able to set and test hypothesis,<br>• Design and undertake an independent basic and/or applied research,<br>• Use appropriate methods and instruments in the conduct of the research,<br>• Generate, analyze and screen scientific data as appropriate that respond to research problem (s)/question(s) |
| • Evaluate, criticize, and present research findings to the scientific community and public at large, | • Learners are able to write acceptable PhD thesis or dissertation that is linguistically, technically and scientifically correct,<br>• demonstrate a rigorous synthesis, evaluation and interpretation of data, implications of the finding from original research undertaking,<br>• Draw conclusions, construct recommendations from the findings,<br>• Appropriate literatures used, correctly cited and listed bibliographically,<br>• Original and contribution of substantial new information to the frontier body of knowledge is demonstrated,<br>• Ability to write scientific papers of merits of publication in refereed journals demonstrated,<br>• Published minimum one paper in a peer reviewed |

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| | journal from the PhD research work undertaken. |
| • Provide outreach and advisory/consultancy services in the food sector, | • Ability to search relevant food science literatures, other relevant information, synthesize, organize and write technical and scientific document,<br>• Ability to present in power point presentation or suitable means to deliver professional services in owns field of specialization |
| • Provide leadership in the food processing industries, food safety, quality assurance, food nutrition, product development and food security. | • Ability to communicate with peers of food science scholars, professional community and society demonstrated through publications and presentations,<br>• Participation in professional organization and related activities |

| **QUALIFICATION STRUCTURE** **SECTION C** | | | |
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| **FUNDAMENTAL COMPONENT** Subjects / Units / Modules /Courses | **Title** | **Level** | **Credits** |
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| **CORE COMPONENT** Subjects / Units / Modules /Courses | PhD seminar | 10 | 60 |
| | PhD Proposal Development | 10 | 90 |
| | Research work, PhD Thesis and peer reviewed scientific paper | 10 | 210 |
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| **ELECTIVE COMPONENT** Subjects / Units / Modules /Courses | | | |
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| **Rules of combinations, Credit distribution** (where applicable): | | | |
| **Level 10 -360 credits** | | | |

## ASSESSEMENT AND MODERATION ARRANGEMENTS

### ASSESSEMENT ARRANGEMENTS

Learners' achievement toward Doctor of Philosophy in Food Science qualification are assessed by both formative and summative tools.

**Formative assessment**

The contribution of formative assessment to the final grade shall be 20%.

**Summative assessment**

The contribution of summative assessment to the final grade shall be 80%.

### MODERATION ARRANGEMENTS

Internal and external moderators to be engaged will be BQA accredited subject specialists in relevant fields with relevant industry experience and academic qualifications.

Both internal and external moderation shall be done in accordance with applicable policies and regulations.

## RECOGNITION OF PRIOR LEARNING (if applicable)

There shall be provision for award of the qualification through Recognition of Prior Learning (RPL) in accordance with institutional Policies in line with the National RPL Policy. Candidates may submit evidence of credits accumulated in related qualification in order to be credited for the qualification they are applying for.

## PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

### LEARNING PATHWAYS

Vertical progression

- Postdoctoral studies in Food Science
- Postdoctoral studies in Food Science & Technology
- Postdoctoral studies in Food Chemistry
- Postdoctoral studies in Food Microbiology
- Postdoctoral studies in Food Technology
- Postdoctoral studies in Postharvest Technology
- Postdoctoral studies in Food Engineering
- Postdoctoral studies in Human Nutrition

- Postdoctoral studies in Chemical Engineering

Horizontal progression

- Doctor of Philosophy in Human Nutrition & Dietetics
- Doctor of Philosophy in Chemical Engineering
- Doctor of Philosophy in Chemistry
- Doctor of Philosophy in Biological Sciences
- Doctor of Philosophy in Public Health

**EMPLOYMENT PATHWAYS**

- Educators in institutions of higher learning
- Researchers in research establishments
- Leaders and advisors/consultants in- Government ministries, agro-processing industries, food standard authorities, regulatory bodies and NGOs (FAO, WHO, UNICEF, WFP, etc.).
- Self-employed and create jobs.
- Food Scientist/Food Chemist
- Food Scientist/Food Microbiologist
- Food Scientist/Food Technologist
- Food Scientist/Food Engineer
- Food Scientist/Food Nutritionist.

## QUALIFICATION AWARD AND CERTIFICATION

For a Candidate to achieve this qualification they must have acquired a minimum of **360** credits. The Candidate should pass all the **CORE** modules.

### Certification

A **Doctor of Philosophy in Food Science** will be awarded to a Candidate upon completion of the qualification in accordance with applicable policies. A certificate and transcript will be issued at award.

## REGIONAL AND INTERNATIONAL COMPARABILITY

Bench marking comparability was done on with three regional and one international Universities considering the feature of the qualification (credit requirements, original research, PhD Thesis and publications in peer reviewed Journals. Assessment, Moderation and exit outcome requirements). For the regional qualification, all are NQF exit level 10 and similar to the PhD Food Science (NCQF exit level 10). Study duration for PhD Food Science qualification at BUAN/Botswana is minimum of three years.

Doctor of Philosophy in Food Science at the University of the Free State offered at minimum credits of 240 (ID:16953), duration minimum two years.

Doctor of Philosophy in Food Science at the University of Pretoria offered at minimum credits of 360 (02261060). For Pretoria University minimum duration is two years for those complying with all the

requirements for a master's degree on admission and for those less can range from two-fours.

Doctor of Philosophy in Food Science and Technology of Cape Peninsula University of Technology at minimum credit of 360 (ID: 99630), duration minimum of two years.

PhD in Food Science/ University of Wisconsin-Madison, USA- Completion of graduate course requirements (at least 39 credits of the 51 graduate degree credit requirement), graduate school residency (32 graduate degree credits), teaching practicum, earn at least 3.0 cumulative GPA on 4.0 scale and FS 990 (Research PhD Thesis), duration is 4-5 years.

**REVIEW PERIOD**

The qualification will be reviewed every five **(5) years**.

## Appendix A Comparability Matrix for PhD Food Science

| Parameters | BUAN/FST – PhD Food Science | University of the Free State/PhD Food Science (ID:16953) | University of Pretoria/PhD Food Science (02261060) | Doctor of Philosophy in Food Science and Technology of Cape Peninsula University of Technology (ID: 99630) | PhD in Food Science/ University of Wisconsin-Madison, USA |
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| NCQF level | NCQF exit level 10 | NQF Level 10 | NQF Level 10 | NQF Level 10 | PhD |
| NCQF entry level | Level 9 | Level 8 and above | Level 8 and above | Level 9 | |
| Learning assumed to be in place before registration | MSc Degree at NCQF Exit Levels 9 in Food Science and Technology; Food Science; Food Technology; Food Engineering; Human Nutrition, related (agriculture and natural science) | Learn from predominantly written material, Communicate what they have learnt, comprehensively in the medium of instruction, Learn and take responsibility for their own progress. The qualification recognises formal and non-formal prior learning (incorporating experiential learning) at a Higher Education and Training Certificate Level 8+ in agriculture or a functional equivalent | MSc, MScAgric, MInstAgrar or other appropriate degree is a prerequisite for admission to PhD studies. Additional requirements and conditions can be specified by the Dean on the recommendation of the head of department and the supervisor. l Admission is additionally dependent on availability of | The minimum admission requirement for this qualification is either: Master of Technology in Food Technology, Level 9. Or Master of Science in Food Science, Level 9. Master of Food Science and Technology, Level 9. RPL:for admission to the qualification candidates are required to show mastery of the Exit Level Outcomes applicable to a Master's Degree qualification in this field of study by means of a portfolio of evidence. The portfolio of evidence must be submitted by the candidate to indicate that the candidate has mastery of the required disciplinary knowledge and skills in this field of study and is able to conduct | MS degree, or BS with scientific experience (research work and publications) which is found to be equivalent to MS degree by an ad-hoc “Examining Committee”. An entrance exam for admission to PhD program may be required |

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| | | | supervisor/s and/or projects within the department. | research at an advanced level equivalent to that of Master's Degree. Institutional policies, procedures and requirements, in accordance with national legislative requirements will apply in terms of RPL applications. | |
| Credits | 360 | 240 | 360 | 360 | Completion of graduate course requirements (at least 39 credits of the 51 graduate degree credit requirement), graduate school residency (32 graduate degree credits), teaching practicum, earn at least 3.0 cumulative GPA on 4.0 scale and FS 990 (Research PhD Thesis) |
| Assessment criteria | PhD Thesis (formative and summative), Oral examination (summative) | Evidence of learning competency (knowledge, skills and attitude) by means of the following: 1. Leadership in the field of study, 2. Contributing to science in general but to the disciplines served by food science in particular new approaches, 3. Perspectives to specific | Research dissertation (formative and summative) and Oral examination (summative) | Formative Assessment to provide guidance on mastery of critical thinking skills, research skills, advanced academic and digital literacy skills, data analysis and interpretation at various stages [proposal, laboratory (trials and implementation of experimental design) and at different stages of preparing and writing the thesis].<br><br>Summative Assessment. | Pass on preliminary comprehensive exam (drawn from proposal with its experimental design, with preliminary results, remaining work, anticipated outcomes, potential impact of the research), Pass on Defense of PhD Thesis, Submission of final PhD Thesis copy |

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| | | aspects of the science of crop production, 4. Independent and creative research ability and 5. Innovative addition to the pool of knowledge regarding either basic or applied aspects. PhD dissertation, publication of peer reviewed paper in accredited journals, evidence of learning competency (knowledge, skills and attitude) | | Thesis Assessment and proof of a published article in a peer reviewed accredited journal is required. | |
| Moderation | Two internal examiners and one external examiner outside of Botswana | A system of external peer review and evaluation of departments including evaluation of the standards and assessment practices per Department. | External examiners for thesis and oral examination | Three reputable and appropriately qualified external examiners who are also external to the institution are appointed by the institution to assess the thesis. Once approved by these committees the reports are sent to Senate for ratification. | Graduate Program Advisory Committee (GPAC) annual evaluation, preliminary examination (for PhD candidates) and defense. The GPAC is 5 members, 4 must be graduate faculty, at least 3 of those members must be faculty or joint/affiliate faculty in Food Science, with at least one member holding a tenure home in Food Science. One graduate faculty member |

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| | | | | | (representing the minor) must have a tenure home outside of Food Science. The 5th or final member of the PhD advisory committee is either a graduate faculty member or a voting member drawn from a list reviewed annually by Food Science Department Executive Committee |
| Exit level outcomes | Evidence of an original and independent own work, originality and contribution to body of knowledge to the field of food science, published works in peer reviewed journals | Critical cross-field outcomes (Distinguishing themselves as leaders in this field, Applying research methodology to the field of food science, Contributing to science in general, initiate new ideas and approaches for future needs) in Food microbiology, Food chemistry, Food biochemistry, Food economy, Quality parameters of food as arrived at by production of plants or animals for | Ability to do an independent research in the field of Food Science, original contributions to the body of knowledge in the field of Food Science and write scientific research papers for peer-reviewed journals. Pass the examinations and the prescribed modules, as determined in the | 1. Demonstrate a systematic understanding of the field of Food Science and Technology and mastery of the skills and methods of research associated with this field.<br>Have demonstrated a systematic understanding of a field of study and mastery of the skills and methods of research associated with that field.<br>Have demonstrated the ability to conceive, design, implement and adapt a substantial process of research with scholarly integrity.<br>Have made a contribution through original research that extends the frontier of knowledge by developing a substantial body of work, some of | Minimum 3.0 grade point average (4.0 scale), satisfactory grade achievement given by supervisor for progress in research (FS990) each semester, annual assessment report by GPAC, Satisfactory performance as a Teaching Assistant or Practicum Student, pass on PhD defense and submit of final PhD copy |

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| | | food purposes. | study programme:<br>pass the thesis; and<br>pass the final examination on the thesis and general subject knowledge. | which merits national or international refereed publication.<br>Are capable of critical analysis, evaluation and synthesis of new and complex ideas.<br>Can communicate with their peers, the larger scholarly community and with society in general about their areas of expertise.<br>Can be expected to be able to promote, within academic and professional | |