SECTION A:	***QUALIFICATION DETAILS***																	
QUALIFICATION DEVELOPER (S)	Botswana International University of Science and Technology																	
TITLE	Master of Science in Statistics													***NCQF LEVEL***	*9*			
STRANDS (where applicable)	*NOT APPLICABLE*																	
FIELD	*Natural, Mathematical and Life Sciences*		***SUB-FIELD***	*Mathematics and Statistics*										***CREDIT VALUE***	*240*			
New Qualification					*√*							*Legacy 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:

1.1.1 Justification for the Qualification

This qualification will prepare students for opportunities for further studies that could lead to a PhD study in statistics, applied statistics, mathematics (specialization in statistics), biostatistics, and/or bioinformatics. The program is also designed to provide the background for success in a

professional career in statistics.

The Master's Degree will offer opportunities for further advancement to a terminal degree in Statistics to students for those who graduated with a Bachelor Science degree or Bachelor of Science Honours degree in Statistics and related areas, particularly for students who are interested in careers as academicians or researchers.

This qualification will provide Botswana with a good number of graduates with skills and knowledge in quantitative analysis, data science and natural sciences. This will result in the growth of local leadership base of innovative scholars and thinkers. Also, this will assist the country to achieve its goal of being a knowledge-based economy through research. The program will offer the opportunity for students to further develop advanced statistical thinking and quantitative analytic skills to solve complex problems in the sciences and related areas. The Master's degree program will enhance the employability of graduates of the program in government, academia, financial and many other industries.

1.1.2 Needs Assessment Analysis

The need for training in statistics is supported by The Human Resource Development Council (HRDC) report which identified higher degree holders in statistical, mathematical and related associate professionals among those in high demand. The required technical skills were both inferential and applied mathematics skills. In addition, the government of Botswana through NDP11 (2017) mandated universities to produce graduates with Mathematics and Statistics skills.

1.1.3 Stakeholders Involvement

Relevant stakeholders have been consulted in the design of the qualification. The department will continue to engage them since they are key industry players who understand the statistical needs of the various institutions. They provide guidance on ensuring that the learning outcomes are aligned to what is required in the field.

PURPOSE: (itemise exit level outcomes)

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

- Contribute to the development of knowledge at an advanced level in the field of statistics either through the application of existing methods or through the development of new methods.
- Lead data management and statistical analyses for various research projects/studies.
- Communicate in technical and non-technical terms, concepts of probability and statistics in different sectors of the economy.
- Analyse and represent various form of data using ICT skills.

MINIMUM ENTRY REQUIREMENTS (including access and inclusion)

- Minimum Entry Requirements: Bachelor's Degree (NCQF level 7) in the same or a cognate field of study.
- 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) institutional policies in line with National RPL and CAT Policies for access.

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SECTION B	***QUALIFICATION SPECIFICATION***
GRADUATE PROFILE (LEARNING OUTCOMES)	***ASSESSMENT CRITERIA***
1. Develop skills in stochastic modelling relevant to the employment industry.	1.1 Perform data analysis of the various industries. 1.2 Perform data modelling using relevant statistical and mathematical models. 1.3 Differentiate between stochastic and deterministic models. 1.4 Illustrate how Statistical concepts and ideas become generally accepted.
2. Develop the techniques and methods of statistical inference and the applications that are relevant for current and future employment.	2.1 Assess the quality of information using Statistical reasoning. 2.2 Perform data analysis on data arising from a variety of sources. 2.3 Employ appropriate statistical procedures to produce valid inference from data. 2.4 Interpret results of statistical analyses correctly.
3. Effectively use existing methods and develop new statistical tools that involve the use of computer programming languages, such as SAS, SPSS, R and SQL for data analysis in various areas of science that are applicable to problems across different areas.	3.1 Update existing computer programs for implementation of existing statistical models. 3.2 Write new computing programs to implement new models. 3.3 Ability to investigate patterns and relationships in high dimensional and complex data sets and recommend appropriate statistical method of analysis. 3.4 Categorize appropriate statistical computational techniques for different types of data sets arising from different areas.

4. Effectively manage information and coherently communicate and present statistical reasoning and ideas both orally and in written forms using appropriate technical terms.	4.1 Generate scientific report on practical or academic work, by means of coherent written documents, which follow appropriate scientific conventions. 4.2 Present Statistical/Scientific information verbally in front of others. 4.3 Use appropriate referencing methods in which plagiarism is avoided and intellectual property is respected. Use statistics in decision making.
5. Develop solid knowledge of the foundational results of mathematical statistics at the level needed to utilize the statistical texts and applied journals including.	5.1 Solve problems that extend beyond their course work 5.2 Understand methods used in statistical textbooks and statistical journals. 5.3 Review statistical journals and provide feedbacks to authors. 5.4 Present own work in a departmental seminar, statistics conferences and colloquiums. 5.5 Conduct independent research.
6. Develop a solid knowledge of the theory of statistical inference and probability and methods of statistical data analysis, including their implementation in statistical computing languages.	6.1 Conduct independent data analysis. 6.2 Solve statistical problems by applying knowledge of statistical inference and probability. 6.3 Perform statistical analysis of data from industries and organizations. 6.4 Identify an appropriate statistical software to perform data analysis and develop/modify computer code or program to suite the data that is being analysed.

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SECTION C	***QUALIFICATION STRUCTURE***				
COMPONENT	***TITLE***	***Credits Per Relevant NCQF Level***			***Total Credits***
		Level [7]	***Level [8]***	***Level [9]***	
FUNDAMENTAL COMPONENT *Subjects/ Courses/ Modules/Units*	***NOT APPLICABLE***				
CORE COMPONENT *Subjects/Courses/ Modules/Units*	Advanced Probability			*12*	*12*
	Advanced Statistical Inference			*12*	*12*
	Advanced Statistical Consulting			*12*	*12*
	Dissertation of Master of Science Degree in Statistics			*120*	*120*
ELECTIVE/ OPTIONAL COMPONENT *Subjects/Courses / Modules/Units*	*Subjects/ Courses/ Modules/Units* ***Elective/Optional modules: Choose seven Modules (84 credits) from the following list.***	***Credits Per Relevant NCQF Level***			***Total Credits***
		Level [7]	***Level [8]***	***Level [9]***	
	Mathematical Problem Solving			*12*	*12*
	Management and Entrepreneurship			*12*	*12*

	Advanced Stochastic Process			*12*	*12*
	Advanced Multivariate Statistical Analysis			*12*	*12*
	Advanced Time Series			*12*	*12*
	Generalized Linear Models			*12*	*12*
	Advanced Bayesian Inference			*12*	*12*
	Categorical Data Analysis			*12*	*12*
	Advanced Sampling Techniques			*12*	*12*
	Advanced Experimental Design			*12*	*12*
	Bio-Statistical Methods			*12*	*12*
	Design and Analysis of Clinical Trials			*12*	*12*
	Statistical Methods in Epidemiology			*12*	*12*
	Longitudinal Data Analysis			*12*	*12*
	Survival Analysis			*12*	*12*
	Reliability			*12*	*12*
	Industrial Statistics			*12*	*12*
	Queuing Theory			*12*	*12*
	Computer Intensive			*12*	*12*

	Methods				
	Financial Mathematics			*12*	*12*
	Measure Theory			*12*	*12*
	Topics in Statistics			*12*	*12*

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	***Credit Value***
Level 9	***240***
TOTAL CREDITS	***240***

Rules of Combination:

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

- This qualification will have at least **240 credits** and take at least twenty-four months to complete. The credit combination for the qualification based on **156 credits of core components** and **84 credits from elective/optional component**.
- For the Elective/optional Component, choose at least 84 credits from the list of elective/optional modules.

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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 Assessment** - A formative assessment aligned to the module learning outcomes and exit-level outcomes will be administered continuously throughout the learning period in each module. The recommended weights of the formative assessment should be at least 50% and should not exceed 60% of the final marks for that module.

Summative Assessment - Learners shall undergo a summative assessment which may include a written examination at the end of the learning period in each module. The recommended weights of the summative assessment will vary from 50% to 40% of the final marks for that module. All summative practical assessments must, as far as possible, be conducted in real-work settings.

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) will be considered in the award of the qualification in accordance with applicable RPL policy of the ETP which are aligned to BQA/National policies on the same.

CREDIT ACCUMULATION AND TRANSFER

There shall be access and award of credits of the qualification using Institutional Credit Accumulation and Transfer (CAT) Policy in line with the National CAT Policy.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Horizontal progression:

- Masters' degree in related fields such as finance, econometrics, mathematical sciences, operational research, actuarial sciences and epidemiology

Vertical Progression:

- Doctor of Philosophy in Statistics or related areas such as applied mathematics, biostatistics, epidemiology and econometrics

Employment Pathways:

Statistics graduates apply their problem-solving skills to a wide variety of fields and upon successful completion of the degree, graduates qualify to work as:

- Statistical Consultant
- Assistant Lecturer
- Teaching Instructor
- Data Manager
- Data Scientist
- Statistical Modeler (Public health and infectious disease, risk and insurance analysists, weather, and climate)
- Actuarial Scientist
- Statistical Analyst

QUALIFICATION AWARD AND CERTIFICATION

Qualification award:

The students enrolled in the program will be able to obtain a **Master of Science Degree in Statistics**. To obtain the **Master of Science Degree in Statistics** the student must accumulate 248 credits.

Certification:

Candidates meeting prescribed requirements will be awarded a **Master of Science Degree in Statistics** in accordance with standards prescribed for the award of the qualification and applicable policies.

SUMMARY OF REGIONAL AND INTERNATIONAL COMPARABILITY

The qualification compares favourably with other similar Master of Science degree qualifications, regionally and internationally around the world with regards to:

- learning outcomes and assessment criteria,
- number of credits,
- structure and purposes, and

notional learning time/duration

The qualification was benchmarked with a number of qualifications offered by different academic institutions. The following universities and qualifications were used for the comparisons:

i) Regional Institutions

University of Witwatersrand in South Africa

Strathmore University in Kenya

ii) International Institutions

Master of Science degree in Statistics, University College London, England, United Kingdom

Summary of comparison

The proposed MSc qualification, and those at University of Witwatersrand, South Africa and Strathmore University in Kenya and University College London (UCL) in England (in the United Kingdom) are similar in terms of the components and structure, including the core and elective components. The differences observed include a research project in the case of the University College London as opposed to a thesis in the proposed qualification. At the University College London there is a compulsory foundation fortnight module. There are some differences in the number of credits required for the proposed qualification and University of Witwatersrand.

The MSc in Mathematical Statistics qualification at University of Witwatersrand requires learners to complete courses totalling 90 credits, together with a research report accounting for 90 credits making a total of 180 credits. It is at NCQF Level 9.

Strathmore University offers MSc in Statistical Science qualification course covers 16 course units offered over 4 academic semesters and a subsequent dissertation project. Learners are required to complete a total of 240 credits at NCQF level 9.

The MSc Statistics qualification in UCL consists of a non-credit bearing foundation module, eight taught modules accounting for 120 credits and a 60 credits research dissertation totalling 180 credits.

Similarly, the proposed MSc in Statistics qualification is similar the MSc Statistics offered by the University of Witwatersrand, South Africa and Strathmore University in Kenya in terms of the learning outcomes, components and structure, including the core and elective components. For example, the programs prepare learners who are not interested in pursuing PhD for the industry. Also, the programs are well suited those who want to pursue PhD. However, there seem to be some differences in the number of credits required for the proposed MSc in Statistics qualification and that of the University of Witwatersrand.

REVIEW PERIOD

Every five (5) years.

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