QUALIFICATION SPECIFICATION SECTION A							
QUALIFICATION DEVELOPER	**GIPS**						
TITLE	**BACHELOR OF SCIENCE IN COMPUTER SCIENCE**			**NCQF LEVEL**	7		
FIELD	**INFORMATION AND COMMUNICATION TECHNOLOGY**	**SUB-FIELD**	**COMPUTER SCIENCE**				
New qualification		Review of existing qualification		X			
SUB-FRAMEWORK	General Education		TVET		Higher Education	X	
QUALIFICATION TYPE	Certificate		Diploma		Bachelor	X	
	Bachelor Honours		Master		Doctor		
CREDIT VALUE	480 Credits						

RATIONALE AND PURPOSE OF THE QUALIFICATION

RATIONALE

As stated in Vision 2036 ,"The ICT sector contributes significantly to the economy and it also a crucial enabler of efficient product and service delivery across all economic sectors", hence a strong need to produce computer scientists with a broad range of skills. This qualification is geared towards closing the skills gap in the Information Technology sector, specifically in regard to graduates who are able to apply computer technologies in the business environment. Students are trained not only in the technical areas of specialization but also in personal development, communication skills and entrepreneurship.

Furthermore the government of Botswana introduced the ICT policy, called Maitlamo which provides a roadmap about economic transformation through the use of ICT. The policy is geared towards making

Botswana to become a sub-Saharan ICT hub, creating an enabling environment for the growth of an ICT industry in the country with the help of computer scientists.

Given the universality of computer technology in society today, there are many different job possibilities for the graduates upon completion of this qualification such as, software developers, computer hardware technicians, database administrators, computer systems analysts , web developers and IT project managers

This qualification will play a major role in the economic transformation as it provides learners with the necessary skills and knowledge to develop automated business systems as well as computer applications that can be used by individuals and the business sector, thus creating jobs that will benefit the society as well as boosting the economy through either direct employment or entrepreneurship.

DETAILS OF MARKET RESEARCH UNDERTAKEN

A needs assessment survey research was carried out for BSc Computer Science training in Botswana. The objective of the survey was to acquire information on training needs, gaps, options of specializations, program structure, courses, topics, and research areas that are relevant to the needs of the stakeholders and sector organizations related to IT industry. Interviews, focus group discussion with key informants and needs assessment questionnaire to the wider stakeholders were used to collect for the study.

The survey was conducted on purposefully sampled prospective and registered students at the ETP. Public and Private Companies were targeted for stakeholder support. The survey revealed that BSc Computer Science which is the proposed qualification of study at the ETP, commands a discernible niche market share in the tertiary Education Industry.The goal of the survey was to provide information on the relevance of BSc Computer Science within difference Industries as well as to know, if the curriculum is appropriate to the needs of undergraduate computer science students.

The researcher gathered the important information from Government and Private Companies who were interested in having their employees earn higher qualifications by sponsoring them up to the degree

Level. Students who completed similar Programmes from Competitor Institutions would be accepted according to their credit transfer and credits accumulation for exemptions and direct enrolment.

The Survey conducted revealed that there was a 100% Stakeholder response from the targeted companies who were keen to submit enrolment for students into the BSc Computer Science.

The data gathered from the survey revealed that the Information Technology Industry is highly supportive of the degree programme followed by the Government and private companies and parastatals. The great support from the corporate world had a positive significance of the course offered by the Institution in meeting the employer's needs and graduate employability. There was positive correlation between the Corporate Organisations and their employees for training in the Degree Programmes offered by the ETP.

PURPOSE

The purpose of this course is to train students to become highly competitive in the job market and at the same time aligning them to the current technologies as well as the national need.

It aims at:

- Providing learners with graduate level knowledge, specific skills and applied competence in IT that are required to provide opportunities for personal intellectual growth, gainful economic activity and for making rewarding contributions to society.
- Significantly increasing the number of graduates in IT to ensure that they are capable of participating responsibly in the information age currently upon us.

ENTRY REQUIREMENTS (including access and inclusion)

i. BGCSE- Botswana General Certificate of Secondary Education, best 6 subjects with a C, or better in English and Mathematics, or

ii. IGCSE - International General Certificate of Secondary Education, best 6 subjects with a C, or

better in English and Mathematics. iii. Diploma in Computer Science / Equivalent for entry at 2nd year Degree Programme. iv. Advanced Diploma in Computer Science / Equivalent for entry at Top up Degree Programme. v. Maturity Entry with BGCSE passes in English and Mathematics and must have at least 2 years' working experience in the field of computing and a letter from employer confirming experience and Training on the Job.

QUALIFICATION SPECIFICATION **SECTION B**	
GRADUATE PROFILE (LEARNING OUTCOMES)	**ASSESSMENT CRITERIA**
On successful completion of the BSC Computer Science learners shall be able to:	Through given assignments and tests learners should be able to:
1.1 Apply communication and research skills to communicate effectively with a range of audiences.	1.1.0 Create reports to communicate to various business audiences 1.1.1 Demonstrate effective use of electronic mail to communicate to various stakeholders 1.1.2 Apply basic research skills to gather interpret, manipulate and compile data to produce reports.
1.2 Explain the fundamental theorem of calculus and evaluate integrals and derivatives of functions	1.2.1 Show the applications of the Fundamental Theorem of Calculus 1.2.2 Evaluate integrals and derivatives of the

	Trigonometric Functions 1.2.3 Illustrate with the aid examples how you perform optimization using derivatives
1.3 Apply basic skills to build, troubleshoot, maintain computer hardware , operating system and computer networks	1.3.0 Build and configure a computer system to meet a design specification 1.3.1 Install and configure operating system 1.3.2 Use diagnostic software to troubleshoot a computer system 1.3.3 Design and configure different network topologies
1.4 Demonstrate a sound knowledge of programming , web development and databases	1.4.0 Write basic programs accepting input and providing output in C, C# and Java 1.4.1 Design a database using any of the database models 1.4.2 Create web based applications using ASP.Net 1.4.3 Design and build a database which interacts with a web page and computer applications
1.5 Discuss and apply different design techniques of algorithms	1.5.0 Analyse graph algorithms and implement them in C language 1.5.1 Define recursion and its representation in the algorithm 1.5.2 Describe a variety of approaches for algorithm optimisation
1.6 Analyze and design business systems using system analysis and design tools	1.6.0 Use data flow diagrams , flow charts, context diagrams to analyse business systems 1.6.1 Design system user interfaces using the

	interface design principles 1.6.2 Evaluate and maintain designed systems for quality assurance and implementation 1.6.3 Design distributed systems that fulfil business requirements
1.7 Discuss Management Information Systems, e-Business, Entrepreneurship and Professional Issues in IT	1.7.0 Describe management information systems 1.7.1 Explain how information systems have transformed business 1.7.2 Outline E-business infrastructure 1.7.3 Identify different types of businesses and various stakeholders 1.7.4 Explain an organisation's staffing, management structures and marketing principles. 1.7.5 Discuss the ethics, professional codes of conduct as well as health & safety issues at work
1.8 Discuss Artificial Intelligence concepts, Cloud Computing, Virtualization and Information Security issues.	1.8.0 Identify and explain the best approach for acquiring and representing knowledge for expert systems. 1.8.1 Explain information security threats and strategies to eliminate them 1.8.2 Explain cloud computing architecture, deployment and service models 1.8.3 Describe different approaches to virtualization

QUALIFICATION STRUCTURE SECTION C			
	Title	**Level**	**Credits**
FUNDAMENTAL COMPONENT Subjects / Units / Modules /Courses	Business Communication	**5**	**10**
	Statistics	**7**	**10**
	Introduction to Computing and information Processing	**7**	**10**
	Calculus	**6**	**10**
	Research Methodology	**7**	**10**
	Project Management	**7**	**10**
	Entrepreneurship	**6**	**10**
CORE COMPONENT Subjects / Units / Modules /Courses			
	Hardware and PC maintenance	**7**	**10**
	Computational mathematics and digital logic	**6**	**10**
	Introduction to programming	**7**	**10**
	Introduction to Web development	**7**	**10**
	Software Engineering 1	**7**	**10**
	Database principles	**7**	**10**
	Operating Systems	**7**	**10**
	Visual Basic.Net framework	**6**	**20**
	Professional issues in Computing	**7**	**10**
	Data structures	**6**	**10**
	Data communications and networks	**7**	**20**
	Computer Architecture	**7**	**10**
	Object oriented design and programming	**7**	**20**
	Analysis and design of Algorithms	**7**	**10**
	Systems Analysis and Design	**7**	**10**
	Distributed Systems	**7**	**10**

	Management Information Systems	**7**	**10**
	Computer Management And Information Security	**7**	**10**
	Database Design and Development	**7**	**20**
	Software Engineering 2	**7**	**20**
	Human Computer interaction	**7**	**10**
	Virtualization and cloud computing	**7**	**10**
	File Structures	**7**	**10**
	Advanced Web Development in ASP.NET	**7**	**20**
	Artificial Intelligence	**7**	**10**
	Technical Project	**7**	**20**
	Internship	**7**	**40**
	CHOOSE 2 MODULES		
ELECTIVE COMPONENT Subjects / Units / Modules /Courses	C sharp.Net Framework	**7**	**20**
	Advanced Java	**7**	**20**
	Windows Network Administration	**7**	**20**
	Advanced Networking	**7**	**20**

Rules of combinations, Credit distribution (where applicable):

The qualification consists of (Level 5,6 and 7 modules: 480 Credits):

The credit combination for this qualification is from 70 fundamental components, 390 core components and the remaining 40 is from elective components

Credit Distribution

Level and Credits	**Compulsory**	**Electives**
Level 5 Credits - 10	10	0
Level 6 Credits - 60	60	0
Level 7 Credits - 410	370	40

Total Credits -480	440	40	

ASSESSMENTS AND MODERATION ARRANGEMENTS

Integrated Assessment:

Assessment is conducted in accordance to the institution's Assessment Policy. The assessment will consist of summative assessment and formative assessment.

The assessment consists of a compulsory assignment and mid-semester examination and final examination per module.

- Compulsory assignment (25%)
- Mid-semester examination per module (25%)
- Final examination per module. (50%)

Formative assessment

The assessment methods for this qualification consist of mid semester examinations (of 3 hours) and assignment which is submitted at the end of the semester (each will be worth 25% of the final mark). Both the mid semester examinations and assignments are either practical or written. The assessment will be based on the assessment criteria of the module and students will be expected to demonstrate that they met the module's learning outcomes.

Summative assessment

It includes written final examination (of 3 hours) worth 50%. The assessment will be based on the learning outcomes and assessment criteria of the module.

Industry/Work focused assessment

Internship

Practical experience is assessed through Internship. The Internship commences at the beginning of the final semester and students are given a minimum of 3 months of Internship covering the core outcomes of the qualification. Students are assessed by the college attachment supervisor and workplace attachment mentor. During the Internship period, students are expected to write an Internship Report and submit it at

the end of the Internship. The Internship is allocated 40 credits and is a compulsory component of the qualification.

The Internship weight is as follows:

Workplace Mentor evaluation	35%
Student Internship Report	25%
Supervisor's evaluation	40%

Technical Project

A technical project follows the fundamental principles of academic writing, but more extensively, it is an extended piece of writing, usually divided into chapters combined with the developed system. Students have to develop a running system and to submit it together with the technical project report during the first semester of Year 4 .They present their project and system to a panel. The project will be assessed by the student's respective supervisors. In addition, the project is allocated 20 credits and is a compulsory component of the qualification. The technical project consists of:

- Technical Project report 70%
- Technical Project presentation and demonstration 30%

Moderation

Moderation takes place in accordance with the institutional Moderation Policy. This Policy provides for a moderation process that verifies that assessments are fair, reliable, valid, practicable and transparent and also evaluates assessor performance.

Moderation must include both internal and external moderation of assessments. Moderation should also encompass achievement of the competence described both in individual unit standards, exit level outcomes as well as the integrated competence described in this qualification.

Internal moderation requirements

Anyone assessing a learner or moderating the assessment of a learner against this Qualification and Unit Standards must be registered as an assessor with the BQA.

The Examination is set by a team of Examiners who are the Lecturers of the Institution from all branches. The set questions are emailed to the Head Office through the Heads of Departments. They sit down with the module leaders to select the questions which are suitable for that semester's examination according to blooms taxonomy. They would check for the quality of the questions and the pitching of the question, whether they were set using the learning outcomes to ensure all elements regarding the knowledge, skills and competencies are examined.

After, the internal verification process, set questions are uploaded to the Academic Manager who would take the printed question papers to the External moderators for further quality check.

External moderation requirements

External moderators are engaged by the institution as consultants for two purposes, that is pre-moderation and post –moderation of papers.

External Moderators are experts in the field and are subject specialists whom, after receiving the question papers ensure quality and standard of the paper is maintained. They check the consistence of the paper, how questions were articulated starting from lower level to higher level question using the learning outcomes. They may accept or reject the paper if not set according to Blooms taxonomy of cognitive domain. External moderators check the pitching of the question papers. After, the external moderation exercise has taken place the papers are taken to the Institution for corrections and printing for safe storage before the final date of examination.

Moderation of answer scripts.

External moderators have mammoth task to ensure that the answer-scripts are moderated as they constitute or determine the fate of the student. Moderators check and verify whether the examiner was not too lenient, generous on marks or hash and mean on marks. They ensure that there is:

- Consistence: the Script versus the marking key.
- Consistence across all scripts.

- Correct mark Count per question.
- Correct Mark Total Count per Script.
- Correct mark Computation (formulae on mark sheets).
- Correct transfer of marks to Mark Sheet.
- Percentage pass rate calculated.

Moderators give comments, observations and recommendations that would influence the decision of the Senate.

RECOGNITION OF PRIOR LEARNING (if applicable)

RPL is conducted in accordance with the institutional Recognition of Prior Learning Policy. This Policy provides processes and procedures by which RPL is conducted.

The assessment processes involved with RPL are the same as those followed for awarding credits in an academic setting. An RPL candidate seeking credits for previously acquired skills and knowledge must still comply with all the requirements as stated in learning modules and learning programmes and qualifications. The difference is the route to the assessment. RPL assessment takes a holistic view of the process of assessment where the context of the learning as well as the context of the person who is being assessed is taken into account.

Students who do not meet the minimum admission requirements, could, under certain conditions, apply for admission based on recognition of prior learning (RPL).

Access to the BSC in Computer Science is open to those applicants who are in a possession of a:

NCQF level V Certificate, with endorsement for Degree studies.

Or

Vocational Certificate (NCV) NCQF Level 4, with endorsement for Degree studies.

Or

Applicants who are in possession of a foreign qualification that is equivalent to the NCQF level V Certificate as determined by BQA.

Or

Applicants who are in possession of a Diploma: Information Technology, or equivalent (NCQF Level 6).

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Horizontal Articulation(related qualifications of similar level that graduates may consider)

Graduates of this qualification may consider pursuing related qualifications in any other university such as:

- BSc in Information Technology
- BSc in Computer Systems Management
- BSc in Computing

Vertical Articulation (Qualifications to which the holder may progress to)

Graduates may progress to higher level qualifications such as:

- BSc (Hons) in Computer Science
- BSc (Hons) in Computer Systems Management
- BSc (Hons) in Information Systems & Data Management
- Post Graduate Diploma in Computer Science and other related Postgraduate programmes
- MSc Computer Science

Career opportunities

There are bright career prospects for computer science professionals or software professionals in recent decades. Computer science graduates find job opportunities in a variety of environments in academia, research, industry, government, private, business organizations and even starting their own businesses as IT

Consultants. Graduates of this qualification are also involved in analyzing problems for solutions, formulating and testing, using advanced communications or multi-media equipment, or working in teams for product development.

Computer science graduates can work as:

- IT technician
- Application analyst
- Applications developer
- Data analyst
- Database administrator
- System developer
- Information systems manager
- Systems analyst
- Web developer etc.

These jobs are more focused on critical and analytical thinking, and may require various certifications to prove your expertise in the field therefore graduates may further their education by pursing professional courses and varied certification on and which includes and not limited to the following; Networking ,Computer Auditing, Computer Forensics, Computer Security to enrich their knowledge in Information Technology.

QUALIFICATION AWARD AND CERTIFICATION

Only after passing all modules in the qualification and obtaining 480 credits, the student can successfully be awarded the Qualification Certificate and transcript in BSc Computer Science. Therefore, there is only a single exit award, which is awarded after 4 years.

REGIONAL AND INTERNATIONAL COMPARABILITY

This qualification compares with the following 3 regional universities and 2 International universities as

follows:

REGIONAL

Northrise University (ZAMBIA)

The Bachelor of Science in Computer Science BSc (CS) degree is a four (4) year program that is specifically designed to provide technical knowledge, skills and background in the design and organization of computer systems. To be eligible for the award of the degree Bachelor of Science in Computer Science BSc (CS), students must satisfy the following requirements: 5 foundation modules and 19 core modules worth 420 credits

The qualification will enable learners to:

1. Acquire and develop in-demand knowledge, skills and experiences that enable them to:

- Be valued employees in a wide variety of occupations in industry, government and academia, in particular as computer scientists and software engineers;
- Model, simulate, and solve computational problems using appropriate theoretical and experimental methods, producing reliable and secure network systems;
- Design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.
- Apply mathematical foundations, algorithm principles, and computer science theory in the modelling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs involved in design choices.
- Analyse a problem, and identify and define the computing requirements appropriate to its solution

Each module, excluding the Final Project, is assessed either by coursework or a combination of coursework

and a written examinations follow:

- Coursework 50%
- Written examination 50%

University Of Namibia

The university offers Bachelor of Science in Computer Science (Honours) degree programme for duration of four (4) years. It consists of the following key modules: Programming, Networking, Artificial Intelligence, Data structures , Software Engineering, Databases ,Introductions to Digital Electronics, Web Design, Research Methodology

The qualification is specifically designed to provide learners with:

- Technical knowledge, skills and background in the design and organization of computer systems.
- The ability to critically evaluate design paradigms, languages, algorithms, and techniques used to develop complex network systems.
- The ability to evaluate and respond to opportunities for developing and exploiting new technologies, through networking, programming, software engineering and database administration

It focuses on the practical and theoretical dimensions of computer science, and prepares students for careers in the fields of software development, computer networking, databases and security. The concentration in networking focuses on network infrastructure and network security aspects and prepares students to handle information technology (IT) security infrastructure challenges that arise in the design, analysis, and implementation of computer networks. This concentration emphasizes the theory and technology behind network design, operation, performance, and defense against security threats

Midlands State University (Zimbabwe)

The Computer Science (BSc) concentrates primarily on the Networking, Systems Development, Programming and Hardware components of Information technology for duration of four (4) years. It consists of 34 core and fundamental modules. There is mandatory industrial attachment in 3rd year of the qualification for one year. . Their assessment comprises of 30% coursework and 70% exam. Some of the modules offered are computer architecture, digital logic design, programming, Systems Analysis and

Design, Artificial intelligence, Management Information systems and Computer security. These modules helps learners to:

- Provide them with an understanding of the need for computer security and the technologies that support it
- Apply Artificial Intelligence techniques to particular problems such as game playing and decision making
- Demonstrate object-oriented programming skill set
- Gather data to analyse and specify the requirements of a system.
- Build general and detailed models that assist programmers in designing and implementing systems.

INTERNATIONAL

Kingston University

The computer science programme at **Kingston University** is driven by the philosophy of 'learning through making'. The focus is strongly on facilitating hands-on experience; student led and owned product portfolios and producing industry-ready graduates. The duration of the course is 4 years full time. The students embark on their industrial attachment in their third year

This course assumes no prior knowledge of computer science. The current guided option routes are designed around the most in demand sectors in the industry. They are Software Engineering, User Experience Design, Web and Mobile App Development, Networking and Network Security.

The course consists of core modules, optional modules and one year of industrial placement. Each of the modules has 30 credits except for industrial placement with 60 credits. Learners will acquire knowledge of computer architecture, databases, systems design, programming, web development, network communication, software design, digital entrepreneurship and mobile applications. The assessment strategy include involves an exam and the development of a portfolio reporting both theoretical and practical knowledge of the fundamental concepts addressed in the modules

University of Liverpool in United Kingdom offers BSc Computer Science Honours Degree which includes designing and building hardware and software systems for a wide range of purposes and processing, structuring and managing various kinds of information.

The first two years cover a range of compulsory modules including: Programming in Java; Computer systems; Databases; Software Engineering; Computer Networks; Distributed Systems. You then choose from a selection of modules representing the cutting-edge of computer science today. These cover topics such as bio computation, introduction to computational game theory and complex social networks, amongst others. This degree includes a second year group software project and an honors year individual project. The assessment comprises of 80% exam and 20% coursework for all the theory modules and 100% coursework for all the practical modules. The qualification will help learners to:

- Demonstrate the principles underlying the design of high level programming languages.
- Explain how the principal components of computer-based systems perform their functions and how they interact with each other.
- Provide the skills to manage and maintain a database system using Database Management Systems such as Microsoft SQL Server.
- Explain networked computer systems and key protocols as well as technologies used in the Internet.
- Provide an understanding of the technical issues involved in the design, analysis and evaluation of modern distributed systems and algorithms.
- Develop an understanding of the problems associated with the development of significant computing systems and appreciate the techniques and tools necessary to develop such systems efficiently, in a cost-effective manner.
- Gain experience of carrying out a large piece of individual work and in producing a dissertation.

Conclusion

BSc Computer Science compares with these regional and international qualifications. Although the qualifications examined above generally follow similar structures and standards, there are differences. The major variation is in duration, elective modules and industrial attachment. All regional universities except Midlands State university don't offer attachment during the course.

This qualification gives learners elective modules in NCQF level 6 and 7. The learners go for industrial attachment in their final year which enables them to apply theoretical and practical computer science knowledge and skills. It also aims to equip students with the ability for critical thinking and lifelong learning that helps them to keep in pace with the rapid development of the technology in Computer Science
REVIEW PERIOD
This Qualification will be reviewed after every 5 years.
Other information – please add any supplementary information to help the application for this qualification for NCQF Registration.