University of Botswana
Faculty of Science
Department of Computer Science

TYPE OF PROPOSAL:

New Programme for
B.Sc. Information Technology

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Departmental Board	October 6, 2009
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1. Introduction

1.1. Background

The Department of Computer Science has been offering a B.Sc. degree in Computer Science since 1992 and a B.Sc. degree in Computer Information Systems since 2004. The department has also been offering M.Sc. degrees in Computer Science and Computer Information Systems since 2004. The last major review of the curriculum for the B.Sc. degree programmes was in 2003 and no major review has been done for the M.Sc. programmes. Taking into consideration the increasing demand of the industry for IT professionals and the fast development of the computing field, regular revision of curriculum is very important.

Curriculum development is a dynamic process and very much so in the field of computing. Regular revision and updating of the curriculum is vital to improve the quality and relevance of the programmes, to cope with the rapid changes in the computing field, and to adapt the curriculum in relation to the needs and conditions of the industry in the country. In light of this, the Department of Computer Science initiated evaluation of its curriculum in 2008 through external review, internal curriculum review committee, and surveys on ICT human resource needs in the country.

The department has been working on the revision of its programmes to identify the shortcomings of the current curricula and come up with revised curricula for both undergraduate and graduate programmes. In order to identify the shortcomings of the existing curricula and propose modifications, the committee gathered input from various sources. The following are the main sources used during the revision of the current curriculum.

a) the experience gained in the implementation of the programmes,
b) input from students who have been on the programme,
c) the report of the external reviewer,
d) report of a Fulbright Scholar who spent his sabbatical in the department,
e) the Report of the Maitlamo project (Botswana ICT Policy development project 2005),
f) global trends in the field of computing as reported in the ACM/IEEE-CS/AIS/AITP Computing Curricula report and IT 2008.

In addition to the sources listed above, the department conducted a comprehensive survey on the ICT human resource need in the country so that a better picture of the industry can be captured. The main objective of the survey was to identify ICT human

resource shortage in both the private and public sector and the type of knowledge and skills required to successfully accomplish their organizational tasks.

This survey helped us to identify the knowledge and skills gap that may exist between the academic and the industry in the country in the area of computing. For this purpose, the committee designed three types of questionnaires to gather data from government organizations and private companies which have strong IT departments (32), experienced IT professionals (15) and IT vacancies advertised on news papers for the period January 2008 to December 2008 (7 newspapers in the country which are published daily and weekly with a total of 406 vacancies).

An analysis of the survey data reveals that many organizations expect specialized (mainly practical), product specific knowledge and skills from computing graduates. In addition, it was observed that organizations expect organizational skills apart from the technical knowledge. A majority of the organizations who took part in the survey indicated their interest in graduates with knowledge of computing combined with management and/or finance. The challenge is thus to produce graduates who can be as adaptable as possible to different environments with minimum additional training investment. Obviously, an academic degree education can't focus on specific product training but products can be embraced for the practical part of appropriate courses. Academic degree education should provide an adequate knowledge of the principles, concepts and techniques behind such products so that graduates can easily manage different products independently.

Therefore, this new curriculum has been designed to address the needs expressed above by emphasizing the use of more applied hands-on experience, practical applications, exercises, and projects where appropriate. For example, to address practical exposure issues, the department proposed the use of products such as Oracle for the practical sessions of Database related courses. In addition, the department is offering certification courses such as CISCO so that interested students can prepare themselves for the industry. The department is also in the process of establishing other certification courses such as Microsoft which will improve the employability of graduates of the program.

On the basis of the findings and the corresponding assessment of the requirements for the rapid development of the ICT sector, a new programme, namely, **B.Sc. Information Technology** has been proposed.

1.2. Rationale

Today, organizations of every kind are dependent on information technology. They need to have appropriate systems in place. Those systems must work properly, be secure, and be upgraded, maintained, and replaced as appropriate. IT professionals assume responsibility for selecting hardware and software products appropriate for an organization, integrating those products with organizational needs and infrastructure, and installing, customizing and maintaining those applications for the organization's computer users.

An investment on IT solutions is considered as a strategically important approach for a competitive organizational performance. This organizational performance is

achieved, not only through the deployment of the technology but also, through the deployment of appropriate human resource specifically trained to adapt technological solutions to organizational needs. Globally, the need for IT professionals has increased significantly over the last few years. Recognizing this demand, the government of Botswana has been sending students abroad and to local private institutions to study Information Technology.

In addition, the Department of Computer Science has conducted ICT human resource survey to identify the knowledge and skills that are required by the industry in the area of computing. The sample had a good representation from government and private ICT institutions.

An analysis of the survey data revealed that a significant number of organizations require ICT professionals with a degree in Information Technology almost equally as those with Computer Science and Information Systems degrees which are offered at the department. The result also supports the fact that as worldwide dependence on technology grows; the demand for informed and experienced Information Technology professionals has also grown.

Therefore, the program has been designed to offer competitive credential that will equip IT professionals with technical as well as leadership positions within organizations. The program would provide the knowledge and skills necessary to successfully apply Information Technology theory and principles to address real world business opportunities and challenges in organizations.

Lastly, the decline in enrolments in traditional computing programs worldwide has led to a soul searching among computing professionals in academia. One international trend that seems to cut across all regions is the attraction of students to new computing programs such as Information Technology. The introduction of the BSc. IT program in the department is one of the ways to broaden the scope of its programmes and make it more attractive and diversified to potential students.

1.3. Sustainability

Looking at the demand for such graduates both locally and internationally, we believe that it can attract a significant number of students. In addition, as the current market indicates, IT professionals are relatively highly paid compared to graduates from other disciplines. This is one motivation for students to enrol into the proposed programme. Moreover, the government's scarce skills survey in 2008/2009 also indicated that IT professionals are the second most scarce in the country.

In addition, IT graduates can be employed by both the ICT industry and other sectors (where ICT is an enabler). Since both the ICT industry and the other sectors are expected to grow and be diversified, the need for IT professionals will also grow. This will require a continuous supply of IT professionals which demonstrates the need for educating such professionals.

1.4. Employability

Modern organizations, both small and large, are now almost dependent on Information Technology solutions for operations, administration, management, and planning of their day to day activities. As a result, employment opportunities for IT graduates are plentiful and varied. In fact, a competent IT graduate is employable in many positions as an IT program emphasizes knowledge combined with practical, hands-on expertise.

Even though computing graduates did not have major difficulties in getting jobs so far, the department has put different mechanisms to improve the employability of its graduates. The first one is industrial attachment. Industrial attachment has dual purposes. First, it serves to expose students to the real world environment where they will apply the knowledge and skills that they have learnt in the University. It also gives them the chance to understand the social, technical, and political issues related to a work environment. The second mechanism is the final year project which demonstrates their ability to integrate knowledge from different areas to solve a real problem. Such an experience is very vital for employment as employers usually prefer graduates with ability to solve real problems. The third mechanism is the provision of industry recognized certificates. The department is already running CISCO certifications training and is also in the process to introduce certification trainings such as Oracle and Microsoft. These certifications improve the chance of employability of the graduates even though the certifications are not part of the core curriculum. Those interested can register and take the training.

1.5. Alignment with the UB Vision

The department has the vision of becoming a leading academic unit in Computing in Africa and the region. In line with this vision is the provision of quality, relevant, and diversified programmes that advance the intellectual capacity of the nation.

The proposed programme will provide additional choice to students coming to the department who are interested in a programme that emphasizes on technology, an enormously vibrant field, which is a primary engine behind much of the world's economic and social change. The programme will also contribute towards UB's priority areas of extending access and participation and the provision of relevant and high quality programmes.

1.6. Aims of the Programme

This program aims to provide students with the necessary theoretical and practical IT skills and knowledge to take on appropriate professional positions in organizations. The program will produce graduates who possess the right combination of knowledge and practical hands-on expertise to take care of both an organization's information technology infrastructure and the people who use it. The graduates will have capacity to take a lead in advocating for users and meeting their needs within an organizational and societal context through the selection, creation, application, integration and administration of computing technologies.

1.7. Objectives of the Programme

The objectives of the programme are to equip students with the following graduate attributes:

a. Ability to explain and apply appropriate information technologies and employ appropriate methodologies to help an individual or organization achieve its goals and objectives;
b. Ability to manage the information technology resources of an individual or organization;
c. Ability to anticipate the changing direction of information technology and evaluate and communicate the likely utility of new technologies to an individual or organization;
d. Ability to understand the scientific, mathematical and theoretical foundations on which information technologies are built;
e. Interpersonal communication skills, strong sense of social commitment and professional ethics, ability to act independently and organization of thought to solve ICT related problems.
f. Critical and creative thinking skills
g. Entrepreneurship and employability skills
h. Organizational and teamwork skills
i. Self-directed, lifelong learning skills

1.8. Graduate Profile

In line with the mission of the department, the graduates of this programme will have enhanced capacity for the following

a. An ability to apply knowledge of computing and mathematics appropriate to the discipline
b. An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution
c. An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs
d. An ability to function effectively on teams to accomplish a common goal
e. An understanding of professional, ethical, legal, security and social issues and responsibilities
f. An ability to analyze the local and global impact of computing on individuals, organizations, and society
g. An ability to use and apply current technical concepts and practices in the core information technologies
h. An ability to identify and analyze user needs and take them into account in the selection, creation, evaluation and administration of computer-based systems
i. An ability to effectively integrate IT-based solutions into the user environment
j. An understanding of best practices and standards and their application
k. An ability to assist in the creation of an effective project plan.

2. Expected Intake and Outputs

The following table presents the projected student intake and output of the programme.

Table 1: Projected student intake & output

Academic Year	2010/2011	2011/2012	2012/2013	2013/2014
Intake	40	40	40	40
Output				35
Attrition Rate	2	2	1	0

3. Resources

3.1. Human Resources

The staff to student ratio, taking into consideration the GEC course, is about 1:100 and without the GEC course is 1:10. Attracting the necessary human resources requirement for the department has been a source of challenge since the inception of the department because of high demand for computing academicians globally.

The curriculum being proposed will allow the department of Computer Science to attract more students into our programmes. This will essentially require more teaching staff and assistants. But if the trend from recent years persists, not only are we going to be in short of teaching staff, we will also be facing a problem of recruiting enough capable teaching assistants. As most courses are drawn from the existing Computer Science and Information Systems programmes, the requirement for new staff members is not urgent. The programme can be run with the existing staff. However, it is important to fill those positions as per the department's establishment in order to strengthen the programme. The major problem for the department so far has been the difficulty of recruiting senior staff members to fill the existing positions. Currently, the department has 2 associate professors, 4 senior lecturers, and 17 lecturers.

3.2. Physical Resources

3.2.1. Available Physical Resources

The department of Computer Science has six laboratories dedicated to undergraduate students and two laboratories to graduate student research. There are two other research laboratories for lecturers and students. Find following how the laboratories are designated:

- Computer labs 232-117 and 232-118 are used for teaching programming in the UNIX environment.
- Computer labs 232-119 and 232-120 are used for teaching programming in the Microsoft Windows environment.
- Computer labs 232-115 and 232-116 are dedicated for final year projects and primarily used by final year students.

- Computer labs 232-111 and 232-112 are used for graduate students research and teaching.
- Computer lab 233-G05 is used for computer network teaching and research (this is also a faculty lab).
- Computer lab 229-2 and others within the university are for GEC 121 and GEC122.
- Computer lab 232-116 is a small office converted to be the staff research laboratory.

3.2.2. Additional Physical Resources Requirements

The physical resources at the moment require upgrading due mainly to the increase in class sizes, mostly from other faculties requiring the services of the department. This is forecasted to increase due to faculties offering programmes with a significant IT requirement. To mention a few of these faculties, we have Humanities, Science, FET, Social Sciences, Education, etc.

The department of Computer Science takes cognizance of the plan to provide more computing laboratories in the new multi-disciplinary and health sciences buildings. However, the current laboratories need to be upgraded to improve the quality of service we are offering to our students and the University. The computers, especially our server farm, are in dire need of larger uninterrupted power supply units to cater for the incessant power disruption within campus. Hopefully, the new laboratories will be equipped appropriately and in line with the department's mission and vision.

Therefore, as part of this proposed program, what the department requires is the upgrading of the existing laboratories and fully furnishing the new computing laboratories in the new building which can be handled according to the normal budget process.

3.2.3. Available Physical Facilities and Future Needs

The available physical facilities and future departmental needs are as specified in Table 2 below.

Table 2: Available physical resources and future needs

	Laboratory	Current State	Future Requirement
1	232/105 Fourth Year Laboratory	– 23 PCs(MS Windows XP) – 1 security camera – 2 x 24 port Cisco switches – 30 garden chairs	– Newer Machines (MS Vista compatible) – 17 " TFT Screens – Mounted overhead projector – Extra security camera – New network switch – Proper laboratory chairs
2	232/106 Fourth Year Laboratory	– 23 PCs(MS Windows XP) – Limited to 30 PCs – 1 Security camera	– New machines(MS Vista compatible) – 17 " TFT Screens – Mounted overhead

		– 2 x 24 port Cisco switches – 30 garden chairs	projector – Extra security camera – New network switch – Proper laboratory chairs
3	232/109 Server Room	– 3 Linux/Servers – 3 MS Windows Servers – No security camera	– Security camera – New master network switch
4	232/111 Master's Laboratory	– 8 PC's(MS Windows XP) – 1 security camera – 1 x 24 port Cisco switch	– 15 PC's(MS Vista Compatible) – Mounted overhead projector – Extra security camera – New network switch – Proper laboratory chairs
5	232/112 Master's Laboratory	– 30 thin clients – 1 security camera – 1 x 24 port network switch	– Mounted overhead projector – Extra security camera – New network switch – Proper laboratory chairs
6	232/116 Research Laboratory	– Connection to network via UTP cabling – CCNA Bundles for networking course.	– Fibre optic cabling – Mounted overhead projector – Security camera – New network switch – Proper laboratory chairs – Blade server for High performance computing.
7	232/117 Second Year Programming Lab	– 40 PC's running Linux – 2 x 24 port Cisco switches – 1 security camera – 40 garden chairs	– Mounted overhead projector – Extra security camera – New network switch – Proper laboratory chairs
8	232/118 Second Year Programming Lab	– 30 PC's running Linux – 2 x 24 port Cisco switches – 1 security camera – 30 garden chairs	– Mounted overhead projector – Extra security camera – New network switch – Proper laboratory
9	232/119 Third Year Laboratory	– 30 PC's(MS Windows) Vista capable – 2 x 24 port Cisco switches – 1 security camera – 30 garden chairs	– Mounted overhead projector – Extra security camera – New network switch – Proper laboratory chairs
10	232/120 Third Year Laboratory	– 30 PC's(MS Windows) Vista Capable – 2 x 24 port Cisco switches – 1 security camera – 30 garden chairs	– Mounted overhead projector – Extra security camera – New network switch – Proper laboratory chairs
11	209/2 GCE Laboratory	– 29 PC(MS Windows) 5years old	

4. Departmental Regulations

4.1. Preamble

The department has found it prudent to update its entrance requirements to be able to compete fairly for students with its competitors. Therefore, entry to the programme will be direct entry to year 1.

4.2. General Provisions

Subject to the provisions of General Academic Regulations, the following Departmental Regulations shall apply.

4.3. Programmes and Titles of Programmes

The programme is a single major programmes leading to the award of **B.Sc. Information Technology**.

4.4. Entry Requirements

Subject to the General Academic Regulation 00.5, the following departmental programme entry requirements shall apply for the programme:

i) For entry into 100-level, candidates must have a minimum grade of C in Mathematics and two other science subjects with computer studies recognized as a science subject, with a minimum grade of D in English.

ii) For entry into the programme at higher level:

a. Transfer student from an Information Technology or equivalent programme from a higher institution considered equivalent to the University of Botswana, subject to General Academic Regulation 00.313.
b. Candidates holding a post Secondary qualification which is considered by the department as being at least equivalent to the 100-level of the programme. Those who do not meet this criterion may be required to take some 100-level courses.

4.5. Assessment

Subject to the General Academic Regulation 00.81, the following Special Regulations shall apply:

a. Where examination is involved in the assessment of a course, the weighting between CA and examination shall be 1:1 for practical courses and 1:2 for theoretical courses and the final grade shall be calculated as weighted average of CA marks and Final Exam marks.
b. Duration of Final Exams – 2 to 3 hours.
c. CA marks will be calculated based on at least three assessments for a course

d. Specific requirements for CA marks calculations shall be as specified for each course.
e. The final year project course, CSI405, shall be assessed according to the guidelines provided by the department.

4.6. Additional Streams

Additional streams of specialization areas shall be defined from time to time as the department may deem necessary.

4.7. Progression from Semester to Semester

Regulations governing progression are as set out in General Regulations 00.9.

4.8. Award

To be awarded a degree, a student must satisfy appropriate provision of General Academic Regulation 23.71.

5. Program Structure

5.1. Preamble

Most of the Computing courses for this program are drawn from the Computer Science program. The Computer Science program has been revised recently with a major review. The revision changed the duration of the program from 3 years to 4 years and introduced a number of new courses and modified many of the existing ones. This program takes advantage of the revised program by incorporating those new courses and modified courses which are relevant for this program. In addition, there are new Computing courses specifically designed for this program which are indicated in bold format.

5.2. Structure

Semester I

Courses	Type	Credits	Prerequisite
CSI131 Discrete Structures	Core	3	
CSI141 Programming Principles	Core	3	
CSI161 Introduction to Computing	Core	3	
STA116 Introduction to statistics	Core	4	
GEC111	GEC	*2*	
GEC121	Exempt		
Total		***15***	

Semester II

Courses	Type	Credits	Prerequisite
CSI132 Discrete Structures II	Core	3	CSI131
CSI142 Object-Oriented Programming	Core	4	CSI141
MAT111 Introductory Mathematics I	Core	4	
ECO111 Basic Micro Economics	core	*3*	
GEC112	GEC	*2*	
GEC122	Exempt		
Total		***16***	

Semester III

Courses	Type	Credits	Prerequisite
CSI242 Data Structures	Core	3	CSI132, CSI142
CSI244 Information Management	**Core**	**3**	
CSI293 Information Technology Fundamentals	**Core**	***3***	
MGT202 Small Business Management	Core	3	
MAT122 Introductory Mathematics II	Core	*4*	
Total		**16**	

Semester IV

Courses	Type	Credits	Prerequisite
CSI262 Database Concepts	Core	3	CSI242
CSI263 Computer Architecture	Core	3	CSI161
CSI223 Systems Programming	core	3	CSI242
MGT200 Organisational Design and Development	Core	3	MGT100
Min 3 credits from:			
ECO112 Basic Macro Economics	Optional	3	
STA211 Statistical Methods	Optional	3	
LIS 227 Introduction to Knowledge Management	Optional	3	
Total		**15**	

Semester V

Courses	Type	Credits	Prerequisite

CSI354 Operating Systems	Core	3	CSI263, CSI242
CSI374 Computer Networks	Core	3	CSI141, CSI263
CSI342 Systems Analysis & Design	Core	3	CSI262
MGT301 Organizational Behaviour	core	3	MGT200
Elective		3	
Total		**15**	

Semester VI

Courses	Type	Credits	Prerequisite
CSI345 Integrative Programming	**Core**	**3**	**CSI354, CSI223**
CSI315 Web Technology and Applications	Core	3	CSI262,C SI374
CSI392 Human Computer Interaction	Core	3	CSI342
CSI341 Introduction to Software Engineering	Core	3	CSI342
Min 3 credit from			
MGT303 Entrepreneurship and Business Formation	Optional	3	MGT202
BIS304 Management Information Systems	Optional	3	
Total		**15**	

Winter Semester

Courses	Type	Credits	Prerequisite
CSI352 Industrial Attachment	Core	3	CSI354, CSI374, CSI342

Semester VII

Courses	Type	Credits	Prerequisite
CSI481 Database Systems	Core	3	CSI262
CSI472 Social Informatics	Core	3	CSI352
CSI482 Information System Engineering	Core	*3*	CSI345
CSI485 System Administration	**Core**	**3**	**CSI354, CSI374**
Min 3 credit from:			
LAW251 Foundations of Business Law	Optional	3	
FIN200 Business Finance	Optional	3	
LIS 403 Knowledge Management	Optional	3	LIS227
Total		**15**	

Semester VIII

Courses	Type	Credits	Prerequisite
CSI405 Project	Core	4	CSI352, CSI315, CSI341
CSI416 Web Computing	Core	3	CSI315
CSI452 Information Security Administration	**Core**	**3**	**CSI374**
CSI446 Information Systems Project Management	Core	3	CSI482
Min 3 credits from:			
BIS417 Information System Auditing	Optional	3	
MKT401 Marketing Management and Strategy	Optional	3	
Total		**16**	

6. Credit Summary

		Core	Optional	Elective	GEC	Total
Year 1	Sem. 1	13			2	15
	Sem. 2	14			2	16
Year 2	Sem. 1	16				16
	Sem. 2	12	3			15
Year 3	Sem. 1	12		3		15
	Sem. 2	12	3			15
	Winter Sem.	3				3
Year 4	Sem. 1	12	3			15
	Sem. 2	13	3			16
Total		**107**	**12**	**3**	**4**	**126**