KIGALI INDEPENDENT UNIVERSITY ULK

SCHOOL OF SCIENCE AND TECHNOLOGY

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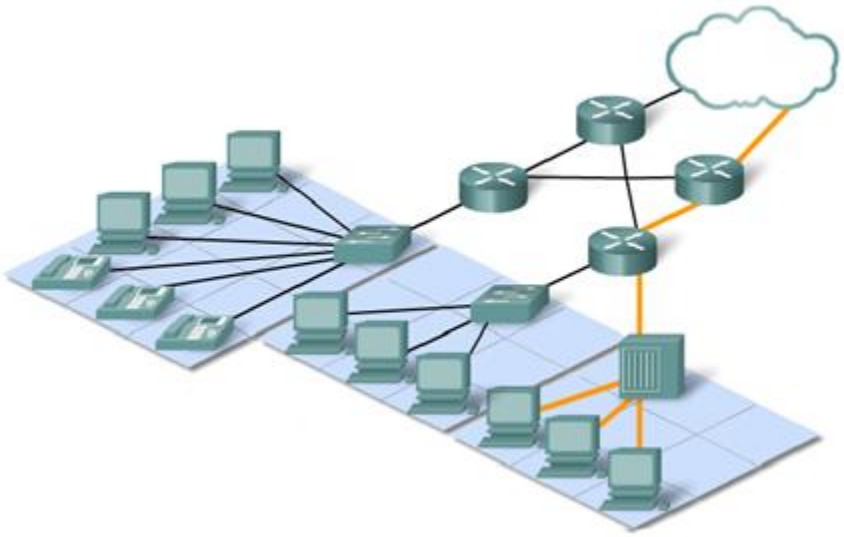
COMPUTER SCIENCE PROGRAMME SPECIFICATION AND MODULES DESCRIPTION



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Republic of Rwanda

HIGHER EDUCATION COUNCIL **KIGALI INDEPENDENT UNIVERSITY ULK**

PROGRAMME SPECIFICATION FORM

1. PROGRAMME DETAILS

1 Programme Title	**Computer Science**			
2 Exit Awards	**Bachelor's Degree (Hons) in Computer Science** **(End Year 4, Level 5)** **Diploma in Higher Education – Computer Science** **(End Year 2, Level 2)**			
3. Modes of Attendance _____ **4 Resource group**:	Part-time		**Full-time**	**X**
	Distance Learning		Work-based	
	Other (please		Short course	
	1	**X**	5	
	2		6	
	3		Other (write in)	
	4			
5 First year of presentation	**2008**			

1. PROGRAMME FUNDING AND ADMINISTRATION

1 **Programme Organiser/Leader:**	KIGALI INDEPENDENT UNIVERSITY ULK
2 **Programme Development Team**	
Name	**School of SCIENCE AND TECHNOLOGY**
(Chair and other members)	1.Dr. NDAYAMBAJE Pius (Dean of the School, Kigali Campus) 2. Mr. KAGARAMA John Baptist (HOD, Kigali Campus) 3.School Council Members (Kigali Campus)
(Library Representative)	Mrs. NIYONSABA Cécile, Director, Library (Kigali Campus)
(CIT Centre Representative)	Dr. NDAYAMBAJE Pius, Dean, School of Science & Technology
(Quality Office Representative)	RUKUNDO Friend, Director, Quality Assurance
3 **School/ School/Centre administratively responsible for the programme** SCHOOL OF SCIENCE AND TECHNOLOGY	

	Authorities Concerned	Date
1	Signature Dr. NDAYAMBAJE Pius, Dean of School (Kigali Campus)	
2	Signature Mr. KAGARAMA John Baptist, HOD (Kigali Campus)	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics (Kigali Campus)	
4	Signature Mrs. NYIRASHYIRAMBERE M. Louise, Deputy Vice-Chancellor Adm. & Fin(Kigali Campus)	
5	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature Mrs. NIYONSABA Cécile, Director, Library	
ICT	Signature Dr. Pius, Dean, School of Science& Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

2. PROGRAMME FUNDING AND NEED FOR RESOURCES

2.1. Student numbers:

Intake per year: **100** into Level: **1**

Eventual population, all years: **400**

2.2. Staffing (Estimated numbers of Permanent Staff at each grade)

	Year 1	Year 2	Year 3	Year 4	SOURCE OF FUNDS
Academic Staffing	**13**	**16**	**13**	**12**	**ULK**
Full Professors	1	1	1	1	**ULK**
Associate Professors	1	2	2	2	**ULK**
Senior Lecturers	1	2	2	2	**ULK**
Lecturers	11	11	8	7	**ULK**

3 PROGRAMME AIMS AND RATIONALE

Today, computing is an enormously vibrant field, a key driver of science and economy. From its conception, computing has become the defining technology of our age; almost every aspect of our personal and our professional lives is affected by information technology and IT industry has became a major part of economy, while influencing profoundly almost any other industry. It is integral to modern culture and is the primary engine behind much of the world socio-economic transformation like innovation in the sciences (human genome project, AIDS vaccine research, environmental monitoring and protection just to mention a few), in engineering, business, government, entertainment and education.

The vision 2020 of Rwanda emphasizes the role of ICT as an engine for a sustainable national socio-economic development. The current stage in ICT policy implementation as shown in NICI III (NICI 2015) insists on services delivery across all sectors and a strong need for strengthening the capacity of the country as an ICT hub, a genuine actor in the ICT industry in the region, and a global player in the software outsourcing at large.

The Private Sector Skills Survey in ICT establishments in Rwanda lauHECd in August 2011 has shown that Rwanda has made gigantic progress in mainstreaming ICT in various sectors and skills development for the sector, but identified occupations in ICT with low proficiency in critical core skills. In terms of ICT training and development in Rwanda, a major challenge seems to be the need of HLIs diversifying their undergraduate and post-graduate academic programmes towards specializations in key emerging ICT areas to target NICI III priority programmes. For the country to achieve Vision 2020 and achieve the goals and outcomes of NICI III, training institutions in Rwanda need to meet the demand on many areas of computing.

The proposed Computer Science programme presented here is designed to meet these expectations. It will provide a rapidly expanding market for graduates who can support and develop the needed complex and cutting-edge solutions and technologies.

It is also geared to equip students with entrepreneurship spirit with tools to succeed in their technology ventures as job creators and winners in that highly competitive market.

Students leaving the Computing programme have in general the highest job satisfaction. Computing is very often associated with innovation, and developments in computing tend to drive it. Creating high-quality computing solutions is a highly creative activity, and computing supports creative work in many other fields. Hence the computer scientists are among the highest paid on the global market.

At the end of the programme students will be equipped with lifelong skills that they can use in a whole variety of jobs: from programming to information systems administration, from IT companies to any company, large or small in software, healthcare, trading and agricultural companies, government and non-government institutions.

ULK Computer science core modules provide basic coverage of **applied mathematics**, **algorithms, data structures, internet and web technologies, information systems, software design, and concepts of programming languages as well as computer architecture.** Theoretical foundations, problem analysis, and solution design are stressed within the program's core materials. Students are exposed to a variety of programming languages and systems and become proficient in more than one higher-level language.

This programme offers a balance of theory, practical skills and experience, providing a sound knowledge and analytical ability to support the professional development.

4 PROGRAMME LEARNING OUTCOMES

The Document "Notes of Guidance: Programme Specification Form, published by HEC (2007) instructed to make learning outcomes of a programme comprehensive but not too detailed; given also the fact that "Learning objectives become more complex and demanding as the student progresses up the levels"; we have opted to rank each levels descriptors as follows: *level one: fundamentals; level two: pre-intermediate; level three: intermediate; level four: pre-advanced and level five: advanced*.

LEVEL ONE LEARNING OUTCOMES

i) Knowledge and Understanding

Having successfully completed the modules in Computer Science-Level One, students should be able to demonstrate fundamental knowledge and understanding of:

- ✓ Ability to apply knowledge of mathematics, science, and engineering.
- ✓ Ability to design and conduct experiments, as well as to analyze and interpret data.
- ✓ Ability to design a system to meet desired needs.
- ✓ Ability to function on teams as leaders or team-members.
- ✓ Ability to identify, formulate, and solve scientific problems.
- ✓ Understanding of professional and ethical responsibility.
- ✓ Ability to communicate and write effective business plan.
- ✓ The broad education necessary to understand the impact of scientific solutions in a global and societal context.
- ✓ Recognition of the need for, and an ability to engage in life-long learning.
- ✓ Knowledge of contemporary issues related to Computer Science.
- ✓ Ability to use the techniques, skills, and modern computer tools necessary for scientific practice.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed all the modules in Computer Science- Level One, students should be able to fundamentally:

- Understand the field scientific concepts.
- Have the knowledge of digital systems.

- Have the knowledge of the fundamentals of computer science with exposure to both analytical techniques and experimentation.
- Have the problem solving skills.
- Have the ability to solve scientific problems by participating in creative design projects.
- Have the ability to solve scientific problems by participating in creative design projects.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed all the modules in Computer Science- Level One, students should be able to fundamentally demonstrate in practice, key computer software knowledge (programming, database management, networking, engineering, etc.).

iv) General transferable skills

Having successfully completed all the modules in Computer Science- Level One, students should be able to fundamentally:

- ✓ Demonstrate the ability to relate and interact effectively in teams consisting of individuals with different interest, backgrounds and professions, and being able to share with them even the most elaborated languages of accounting into a simpler way;
- ✓ Demonstrate the ability to practice high ethical accounting standards when facing employers, in contact with clients, co-workers, as well as the general public. This goes with acting with integrity, honesty and professionalism;
- ✓ Demonstrate a high sense of knowledge diffusion among co-workers, particularly as related to technologies applied to the accounting field.

LEVEL TWO LEARNING OUTCOMES

v) Knowledge and Understanding

Having successfully completed the modules in Computer Science-Level One, students should be able to demonstrate pre-intermediary knowledge and understanding of:

- ✓ Ability to apply knowledge of mathematics, science, and engineering.
- ✓ Ability to design and conduct experiments, as well as to analyze and interpret data.
- ✓ Ability to design a system to meet desired needs.
- ✓ Ability to function on teams as leaders or team-members.
- ✓ Ability to identify, formulate, and solve scientific problems.
- ✓ Understanding of professional and ethical responsibility.
- ✓ Ability to communicate and write effective business plan.
- ✓ The broad education necessary to understand the impact of scientific solutions in a global and societal context.
- ✓ Recognition of the need for, and an ability to engage in life-long learning.
- ✓ Knowledge of contemporary issues related to Computer Science.
- ✓ Ability to use the techniques, skills, and modern computer tools necessary for scientific practice.

vi) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed all the modules in Computer Science- Level One, students should be (at a pre-intermediate stage) able to:

- Understand the field scientific concepts.
- Have the knowledge of digital systems.
- Have the knowledge of the pre-intermediarys of computer science with exposure to both analytical techniques and experimentation.
- Have the problem solving skills.

- Have the ability to solve scientific problems by participating in creative design projects.

- Have the ability to solve scientific problems by participating in creative design projects.

vii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed all the modules in Computer Science- Level One, students should be (at a pre-intermediate stage) able to demonstrate in practice, key computer software knowledge (programming, database management, networking, engineering, etc.).

viii) General transferable skills

Having successfully completed all the modules in Computer Science- Level One, students should be (at a pre-intermediate stage) able to:

- ✓ Demonstrate the ability to relate and interact effectively in teams consisting of individuals with different interest, backgrounds and professions, and being able to share with them even the most elaborated languages of accounting into a simpler way;
- ✓ Demonstrate the ability to practice high ethical accounting standards when facing employers, in contact with clients, co-workers, as well as the general public. This goes with acting with integrity, honesty and professionalism;
- ✓ Demonstrate a high sense of knowledge diffusion among co-workers, particularly as related to technologies applied to the accounting field.

LEVEL THREE LEARNING OUTCOMES

ix) Knowledge and Understanding

Having successfully completed the modules in Computer Science-Level One, students should be able to demonstrate intermediate knowledge and understanding of:

- ✓ Ability to apply knowledge of mathematics, science, and engineering.

- ✓ Ability to design and conduct experiments, as well as to analyze and

interpret data.

- ✓ Ability to design a system to meet desired needs.
- ✓ Ability to function on teams as leaders or team-members.
- ✓ Ability to identify, formulate, and solve scientific problems.
- ✓ Understanding of professional and ethical responsibility.
- ✓ Ability to communicate and write effective business plan.
- ✓ The broad education necessary to understand the impact of scientific solutions in a global and societal context.
- ✓ Recognition of the need for, and an ability to engage in life-long learning.
- ✓ Knowledge of contemporary issues related to Computer Science.
- ✓ Ability to use the techniques, skills, and modern computer tools necessary for scientific practice.

x) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed all the modules in Computer Science- Level One, students should be (at an intermediate stage) able to:

- Understand the field scientific concepts.
- Have the knowledge of digital systems.
- Have the knowledge of the intermediates of computer science with exposure to both analytical techniques and experimentation.
- Have the problem solving skills.
- Have the ability to solve scientific problems by participating in creative design projects.

- Have the ability to solve scientific problems by participating in creative design projects.

xi) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed all the modules in Computer Science- Level One, students should be (at an intermediate stage) able to demonstrate in practice, key computer software knowledge (programming, database management, networking, engineering, etc.).

xii)General transferable skills

Having successfully completed all the modules in Computer Science- Level One, students should be (at an intermediate stage) able to:

- ✓ Demonstrate the ability to relate and interact effectively in teams consisting of individuals with different interest, backgrounds and professions, and being able to share with them even the most elaborated languages of accounting into a simpler way;
- ✓ Demonstrate the ability to practice high ethical accounting standards when facing employers, in contact with clients, co-workers, as well as the general public. This goes with acting with integrity, honesty and professionalism;
- ✓ Demonstrate a high sense of knowledge diffusion among co-workers, particularly as related to technologies applied to the accounting field.

LEVEL FOUR LEARNING OUTCOMES

xiii) Knowledge and Understanding

Having successfully completed the modules in Computer Science-Level One, students should be able to demonstrate pre-advanced knowledge and understanding of:

- ✓ Ability to apply knowledge of mathematics, science, and engineering.
- ✓ Ability to design and conduct experiments, as well as to analyze and interpret data.
- ✓ Ability to design a system to meet desired needs.

- ✓ Ability to function on teams as leaders or team-members.
- ✓ Ability to identify, formulate, and solve scientific problems.
- ✓ Understanding of professional and ethical responsibility.
- ✓ Ability to communicate and write effective business plan.
- ✓ The broad education necessary to understand the impact of scientific solutions in a global and societal context.
- ✓ Recognition of the need for, and an ability to engage in life-long learning.
- ✓ Knowledge of contemporary issues related to Computer Science.
- ✓ Ability to use the techniques, skills, and modern computer tools necessary for scientific practice.

xiv) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed all the modules in Computer Science- Level One, students should be (at a pre-advanced stage) able to:

- Understand the field scientific concepts.
- Have the knowledge of digital systems.
- Have the knowledge of the pre-advanceds of computer science with exposure to both analytical techniques and experimentation.
- Have the problem solving skills.
- Have the ability to solve scientific problems by participating in creative design projects.
- Have the ability to solve scientific problems by participating in creative design projects.

xv)Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed all the modules in Computer Science- Level One, students should be (at a pre-advanced stage) able to demonstrate in practice, key computer software knowledge (programming, database management, networking, engineering, etc.).

xvi) General transferable skills

Having successfully completed all the modules in Computer Science- Level One, students should be (at a pre-advanced stage) able to:

- ✓ Demonstrate the ability to relate and interact effectively in teams consisting of individuals with different interest, backgrounds and professions, and being able to share with them even the most elaborated languages of accounting into a simpler way;
- ✓ Demonstrate the ability to practice high ethical accounting standards when facing employers, in contact with clients, co-workers, as well as the general public. This goes with acting with integrity, honesty and professionalism;
- ✓ Demonstrate a high sense of knowledge diffusion among co-workers, particularly as related to technologies applied to the accounting field.

LEVEL FIVE LEARNING OUTCOMES

xvii) Knowledge and Understanding

Having successfully completed the modules in Computer Science-Level One, students should be able to demonstrate advanced knowledge and understanding of:

- ✓ Ability to apply knowledge of mathematics, science, and engineering.
- ✓ Ability to design and conduct experiments, as well as to analyze and interpret data.
- ✓ Ability to design a system to meet desired needs.
- ✓ Ability to function on teams as leaders or team-members.
- ✓ Ability to identify, formulate, and solve scientific problems.

- ✓ Understanding of professional and ethical responsibility.
- ✓ Ability to communicate and write effective business plan.
- ✓ The broad education necessary to understand the impact of scientific solutions in a global and societal context.
- ✓ Recognition of the need for, and an ability to engage in life-long learning.
- ✓ Knowledge of contemporary issues related to Computer Science.
- ✓ Ability to use the techniques, skills, and modern computer tools necessary for scientific practice.

xviii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed all the modules in Computer Science- Level One, students should be (at an advanced stage) able to:

- Understand the field scientific concepts.
- Have the knowledge of digital systems.
- Have the knowledge of the advanceds of computer science with exposure to both analytical techniques and experimentation.
- Have the problem solving skills.
- Have the ability to solve scientific problems by participating in creative design projects.
- Have the ability to solve scientific problems by participating in creative design projects.

xix) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed all the modules in Computer Science- Level One, students should be (at an advanced stage) able to demonstrate in practice, key

computer software knowledge (programming, database management, networking, engineering, etc.).

xx)General transferable skills

Having successfully completed all the modules in Computer Science- Level One, students should be (at an advanced stage) able to:

- ✓ Demonstrate the ability to relate and interact effectively in teams consisting of individuals with different interest, backgrounds and professions, and being able to share with them even the most elaborated languages of accounting into a simpler way;
- ✓ Demonstrate the ability to practice high ethical accounting standards when facing employers, in contact with clients, co-workers, as well as the general public. This goes with acting with integrity, honesty and professionalism;
- ✓ Demonstrate a high sense of knowledge diffusion among co-workers, particularly as related to technologies applied to the accounting field.

5 PROGRAMME STRUCTURE

5.1. PROGRAMME STRUCTURE IN YEAR 1 COMPUTER SCIENCE (CS)

No	*Module Code*	Module Title	Credits	Hours	Level	Semester	Achievement of the Programme Learning Outcomes
1	***CSC 101***	**English Skills**	**12**	**120**	**1**	**1**	**I, iv**
2	***CSC 102***	**Calculus I**	**12**	**120**	**1**	**1**	**I,ii,iii**
		Unit 1: Differential Calculus	6	60			i.ii.iii
		Unit 2: Simple Integration	6	60			I,ii,iii
3	***CSC 103***	**Fundamentals of Electricity & Electronics**	**12**	**120**	**1**	**1**	**I, ii, ii, iv**
		Unit 1: Fundamentals of	**6**	**60**			

		Electricity Unit 2: Basic Electronics	**6**	**60**			
4	***CSC 104***	**Information Technology** Unit 1: Introduction to Computers Unit 2: Word Processing & Presentations Unit 3: Spread Sheets, Database & Internet	**12** 4 4 4	**120** 40 40 40	**1**	**1**	**I,ii,iii,iv**
5	***CCS 105***	**Introduction to Computer Science** Unit 1: Unit 1: Principles of Programming Unit 2: C Programming	**12** 6 6	**120** 60 60	**1**	**1**	**I, ii, iii, iv**
6	***CSC 106***	**Ethics, Rwandan Culture and Civic Education**	**12**	**120**	**1**	**2**	**I,iv**
7	***CSC 107***	**Calculus II**	**12**	**120**	**1**	**2**	**I,ii,iii,iv**
		Unit 1: Series & Multiple Integration	6	60	**1**	**2**	I,ii,iii,iv
		Unit 2: *Vector Calculus*	6	60			I,ii,iii,iv
8	***CSC 108***	**Computer Hardware Technology** **Unit 1:** Computer Hardware Fundamentals **Unit 2:** Computer Troubleshooting & Maintenance	**12** 6 6	**120** 60 60	**1**	**2**	**I,ii,iii**
9	***CSC 109***	**Computer Programming** Computer Programming with *C++*	**12**	**120**	**1**	**2**	**I,ii,iii,iv**
10	***CSC110***	**Introduction to Scientific Research**	**12**	**120**	**1**	**2**	

Total			**120**	**1200**			

5.2. PROGRAMME STRUCTURE IN YEAR 2, COMPUTER SCIENCE

	Code	Courses in Computer Science	Credits	Hrs	Level	Semester	Achievement of the Programme Learning Outcomes
1.	**CSC201**	**English Language Skills II**	**12**	**120**	**2**	**1**	**I,ii,iii,iv**
2.	**CSC202**	**Linear Algebra**	**12**	**120**	**2**	**1**	**I,ii,iii,iv**
		Unit 1: Matrices	6	60			
		Unit 2: Determinants	6	60			
3.	**CSC203**	**Microcomputer Systems**	**12**	**120**	**2**	**1**	**I,ii,iii,iv**
		Unit 1: Digital Logic Design	6	60			
		Unit 2: Microprocessor & Interfacing	6	60			
4.	**CSC204**	**Database Management Systems**	**12**	**120**	**2**	**1**	**I,ii,iii,iv**
		Unit 1: Introduction to Database Management Systems	6	60			
		Unit 2: Database Design I	6	60			
5.	**CSC205**	**Programming Languages & Paradigms**	**12**	**120**	**2**	**1**	**I,ii,iv**
		Unit 1: Java Programming	6	60			
		Unit 2: Object-Oriented Programming with Java	6	60			
6.	**CSC206**	**Differential Equations**	**12**	**120**	**2**	**2**	**I,ii,iii,iv**
		Unit 1: Ordinary Differential Equations	6	60			
			6	60			

		Unit 2: Partial Differential Equations					
7.	**CSC207**	**Discrete Mathematics** **Unit 1:** Logic & Mathematical Reasoning **Unit 2:** Graphs Theory	**12** 6 6	**120** 60 60	**2**	**2**	**I,ii,iii,iv**
8.	**CSC208**	**Data Structures & Algorithms** **Unit 1:** Algorithms Design & Analysis **Unit 2:** Data Structures & Programming	**12** 6 6	**120** 60 60	**2**	**2**	**I,ii,iii,iv**
9.	**CSC209**	**Data & Computer Communications** **Unit 1:** Data Communications **Unit 2 :** Computer Communications	**12** 6 6	**120** 60 60	**2**	**2**	
10	**CSC210**	**Internet & Web Technologies** **Unit 1 :** Web Technologies **Unit 2 :** Web Programming & Design	**12** 6 6	**120** 60 60	**2**	**2**	
		TOTAL	**120**	**1200**			

5.3. PROGRAMME STRUCTURE IN YEAR 3, COMPUTER SCIENCE

	Module Code	**3rd year/ Computer Science**	**Credits**	**Hours**	**Level**	**Semester**	**Achievement of the Programme Learning Outcomes**

1.	**CSC301**	**English Language Skills III**	**10**	**100**	**3**	**1**	**I,ii,iii,iv**
2.	**CSC302**	**Probability & Statistics** **Unit 1:** Probability **Unit 2:** Statistics	**10** 5 5	**100** 50 50	**3**	**1**	**I,ii,iii,iv**
3.	**CSC303**	**Information Systems** **Unit 1:** Information Systems Analysis **Unit 2:** Information Systems Design	**10** 5 5	**100** 50 50	**3**	**1**	**I,ii,iii,iv**
4.	**CSC304**	**Computer Architecture** **Unit 1:** Computer Architecture I **Unit 2:** Computer Architecture II	**10** 5 5	**100** 50 50	**3**	**1**	**I,ii,iii,iv**
5.	**CSC305**	**Advanced Database Systems** **Unit 1:** Database Administration & Security Unit 2: Database Design II	**10** 5 5	**100** 50 50	**3**	**1**	**I,ii,iii,iv**
6.	**CSC306**	**Networking I**	**10**	**100**	**3**	**1**	**I,ii,iii,iv**
7.	**CSC307**	**Platform Technologies** **Unit 1:** Operating Systems Concepts **Unit 2:** Unix Operating System& Shell Programming	**10**	**100**	**4**	**2**	**I,ii,iii,iv**

8.	**CSC308**	**Human-Computer Interaction** **Unit 1:** Graphical User Interface Concepts **Unit 2:** GUI Design & Implementation	**10** 5 5	**100** 50 50	**4**	**2**	**I,ii,iii,iv**
9	**CSC309**	**Object-Oriented Software Development** **Unit 1:** Introduction to VB.Net **Unit 2:** Object-Oriented Analysis & Design Using VB.NET	**10** 5 5	**100** 50 50	**4**	**2**	
10	**CSC310**	**Research Methodology**	**10**	**100**	**4**	**2**	
11	**CSC311**	**Networking II**	**10**	**100**	**4**	**2**	
12	**CSC312**	**Networking III** **Unit 1:** Cryptography **Unit 2:** Network Security	**10** 5 5	**100** 50 50	**4**	**2**	
		TOTAL	**120**	**1200**			

5.4. PROGRAMME STRUCTURE IN YEAR 4, COMPUTER SCIENCE

	Module Code	**4th year Computer Science**	**Credits**	**Hours**	**Level**	**Semester**	**Achievement of the Programme Learning Outcomes**
1.	**CSC401**	**Numerical Analysis & Applications** **Unit 1:** Numerical Methods **Unit 2:** Numerical Analysis &	**10** 5 5	**100** 50 50	**5**	**1**	**I,ii,iii,iv**

		Programming					
2.	**CSC402**	**Computer Graphics & Vision** **Unit 1:** Computer Graphics **Unit 2:** Computer Vision	**10**	**100**	**5**	**1**	**I,ii,iii,iv**
3.	**CSC403**	**Formal Languages & Automata** **Unit 1:** Formal Languages **Unit 2:** Automata Theory	**10** 5 5	**100** 50 50	**5**	**1**	**I,ii,iii,iv**
4.	**CSC404**	**Intelligent Systems** **Unit 1:** Artificial Intelligence **Unit 2:** Expert Systems	**10** 5 5	**100** 50 50	**5**	**1**	**I,ii,iii,iv**
5.	**CSC405**	**Software Engineering** **Unit 1:** Principles of Software Design **Unit 2:** Software Project Management	**10**	**100**	**5**	**1**	**I,ii,iii,iv**
6.	**CSC406**	**Entrepreneurship Development**	**10**	**100**	**5**	**1**	**I,ii,iii,iv**
7.	**CSC407**	**Operational Research** **Unit 1:** Linear Programming **Unit 2:** Optimization Techniques	**10** 5 5	**100** 50 50	**5**	**2**	**I,ii,iii,iv**
8.	**CSC408**	**Internship**	**10**	**100**	**5**	**2**	**I,ii,iii,iv**
9.	**CSC409**	**Distributed Computing Systems** **Unit 1:** Distributed Systems **Unit 2:** Parallel Computing	**10** 5 5	**100** 50 50	**5**	**2**	**I,ii,iii,iv**

10	**CSC410**	**Data Mining & Warehousing** **Unit 1:** Data Mining **Unit 2:** Data Warehousing	**10**	**100**	**5**	**2**	**I,ii,iii,iv**
11	**CSC411**	**Wireless Networks & Mobile Computing** **Unit 1:** Wireless Networks **Unit 2:** Mobile Computing	**10** 5 5	**100** 50 50	**5**	**2**	
12	**CSC412**	**Dissertation**	**10**	**100**	**5**	**2**	
		TOTAL	**120**	**1200**			

5.5. CURRICULUM MAP for <u>programme</u> outcomes (add rows or columns as required) – tick where outcome is achieved

Learning outcome	Group I: Knowledge & understanding	Group II: Cognitive, Intellectual skills, Application of Knowledge	Group III: Communication, ICT, Numeracy, Analytical Techniques, Practical Skills	Group IV: General Transferable Skills
Level 1	**X**	**X**	**X**	**X**
Level 2	**X**	**X**	**X**	**X**
Level 3	**X**	**X**	**X**	**X**
Level 4	**X**	**X**	**X**	**X**
Level 5	**X**	**X**	**X**	**X**

6. LEARNING AND TEACHING STRATEGY

Generally, for all the five levels, learners will be provided with learning resources, essentially training manuals (courses notes, text books, cases studies, reference materials) in a classroom situation, for the face to face sessions. The Lecturer will be

using a computer as well as a projector for his prepared courses to be presented. During the 2007 Academic Year, the Kigali Independent University has purchased more than 40 branded new projectors to support teaching. Students will be having at their disposal a computer lab with the necessary resources (software and exercises) and computer equipment to create presentations (on cases studies analyses and structured exercises), repeat and reinforce topics taught in classrooms or research topics using the Internet. All, done, in order to achieve projected learning outcomes.

All students will be expected to arrive punctually for each class, fully equipped with all the particular requirements to enable full participation, including textbooks, photocopies, class notes, case studies and writing materials to solve out structured exercises, to participate to case studies analyses in presence of the lecturer, to prepare related presentations and to participate to computers laboratory works, finally, to Submit assignments.

7. ASSESSMENT STRATEGY

Learners will be required to complete all assessment activities to provide evidence of competency. Each session will be accompanied by self directed learning time, for readings, negotiated activities and evidence collection. All learners undertaking this programme will be involved in a meeting with their trainer and will be guided through the proposed strategies for each unit of competency in which they will be involved. In other words. Candidates may be required to demonstrate knowledge and skills on more than one occasion. Assignments should be worked on during a semester and not left till the last minute. Assessment will be undertaken on the recommended dates as indicated by the lecturer or the Department. It is the responsibility of the student to submit or attend scheduled assessments on set times and dates. All the assessments conducted will have to be marked, with comments on weaknesses given to students within reasonable time. As for the assessment pattern, it is presented on the below table:

Component	**Weighting (%)**	**Learning objectives covered**
In-course assessment:		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv for each level**

Continuous Assessment Test 2	**30%**	**I,ii,iii,iv for each level**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv for each level**

8. STUDENT PROFILE AND SPECIFIC ADMISSION CRITERIA

The Student profile and admission criteria are as provisioned by the University Regulations.

10. STRATEGY FOR STUDENT SUPPORT

The Kigali Independent University has put into place regulations as well as practices in line with the National Student Support and Guidance Policy released by the Higher Education Council in April 2007. Following the HEC above mentioned policy, the university students' support and guidance policy caters for the following: Student Induction Policy; Academic Support Policy; Careers Education Information and Guidance Policy; Personal Development Planning; Complaints and Grievance Procedure for Students and Harassment Policy for Staff and Students. Computer Science students will also be supported with the existing instruments and practices.

11. PROGRAMME-SPECIFIC NEED FOR RESOURCES AND UNUSUAL DEMANDS ON INSTITUTIONAL RESOURCES

Among the specific needs for resources is the need for Computer Science Softwares licenses purchase. The need to organize guest lectures with Engineers and Scientists operating on the terrain has also to be stressed. Copies of updated cases studies and structured exercises are also to be noted.

12. STRATEGIES FOR CONTINUOUS ENHANCEMENT AND FUTURE DEVELOPMENT

HEC recommended subject reviews and their conclusions, institutional audits, regular School and departmental follow up on the running of the minimum indicative content as well as the achievement of learning outcomes, coupled with students' evaluations of lecturers at the end of each module or units are paramount.

13. STAFF DEVELOPMENT PRIORITIES

Recruiting more qualified Computer Science lecturers as well as attending trainings into ICT boards as well as seminars, workshops at the national, regional and international levels are amongst the prime staff development priorities.

14. UNIT APPROVAL

Faculties/Schools/Centres contributing to Programme (this table should be signed by the Deans/Heads of all Units contributing to the programme to confirm agreement with the proposal).

School	Dean /Director	Date
1	Signature	
	Print Name: Dr. NDAYAMBAJE Pius, Dean, FST	
2	Signature	
	Print Name: Mr. KAGARAMA John Baptist, HOD	
4	Signature	
	Print Name: School Council Members	

Seen and noted

Library	Signature	
	Print Name: Mrs. NIYONSABA Cécile, Director	
ICT	Signature	
	Print Name: Dr. NDAYAMBAJE Pius, Dean, FST	
Quality Office	Signature	
	Print Name: Lecturer RUKUNDO Friend, Director, Quality Assurance	

5. CENTRAL AUTHORISATION

Resources Confirmation Mrs. NYIRASHYIRAMBERE M. Louise Date: _____

Deputy Vice-Chancellor Administration and Finance (ULK Kigali)

Approved Dr OKOKO OSAMBO Date: _____

Deputy Vice-Chancellor Academics (ULK Kigali)

Approved Senate Dr. SEKIBIBI Ezechiel Date: ----------

Chair

HIGHER EDUCATION COUNCIL

Kigali Independent University ULK

COMPUTER SCIENCE

YEAR 1

MODULES DESCRIPTIONS FORMS

No	*Module Code*	Module Title	Credits	Hours
1	***CSC 101***	**English Language Skills**	**12**	**120**
2	***CSC 102***	**Calculus I**	**12**	**120**
		Unit 1: Differential Calculus	6	60
		Unit 2: Simple Integration	6	60
3	***CSC 103***	**Fundamentals of Electricity & Electronics**	**12**	**120**
		Unit 1: Fundamentals of Electricity	6	60
		Unit 2: Basic Electronics	6	60
4	***CSC 104***	**Information Technology**	**12**	**120**
		Unit 1: Introduction to Computers	**4**	**40**
		Unit 2: Word Processing & Presentations	**4**	**40**
		Unit 3: Spread Sheets, Database & Internet	**4**	**40**
5	***CSC 105***	**Introduction to Computer Science**	**12**	**120**
		Unit 1: Principles of Programming	**6**	**60**
		Unit 2: C Programming	**6**	**60**
6	***CSC 106***	**Ethics, Rwandan Culture & Civic Education**	**12**	**120**

7	***CSC 107***	**Calculus II** **Unit 1:** Series & Multiple Integration **Unit 2:** Vector Calculus	**12** 6 6	**120** 60 60
8	***CSC 108***	**Computer Hardware Technology** **Unit 1:** Computer Hardware Fundamentals **Unit 2:** Computer Troubleshooting & Maintenance	**12** 6 6	**120** 60 60
9	***CSC 109***	**Computer Programming**	**12**	**120**
10	***CSC 110***	**Introduction to Scientific Research**	**12**	**120**
Total			**120**	**1200**

MODULE 1

1. Module code CSC 101 **SCHOOL:** SCIENCE AND TECHNOLOGY

2. Module Title: ENGLISH LANGUAGE SKILLS I

3. Level: 1 Semester: 1 Credits: 12

4. First year of presentation: **2008** **Administering School:** SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

*** Secondary school**

6. Allocation of study and teaching hours

Total student hours _____	Student hours	Staff **hours**
Lectures	**40**	**60**
Seminars/workshops	**10**	**10**
Practical classes/laboratory	**20**	**20**
Structured exercises	**10**	**10**
Set reading etc.	**10**	_____
Self-directed study	**10**	_____
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other:		
TOTAL	120	120

6.1 Brief description of aims and content (not more than five lines)

The module aims at:

- Providing students with sufficient knowledge in the four language skills Listening, Speaking, Reading, Writing, and availing students with techniques in correspondence and communication, letter writing, Memorandum, report writing, and minutes of meeting compiling.

- To make students understand that English is a vital working tools globally.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students should be able to demonstrate knowledge and understanding of:

1. The fundamental knowledge in English letter writing and other business documentary writings, and the importance of English in general

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

2. Apply the English language skills in the day-to-day life.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

3. Manage to express themselves wherever they go, and in whatever the students do in English language

iv) General transferable skills

Having successfully completed the module, students should be able to:

4. Cope up with the English speaking community

7. Indicative Content

- Language practice

-The continuous use of the English language in an intensive way

8. Learning and Teaching Strategy

-Student centred:

-Face to face lectures

-giving students research topics

- Workshops and conferences

9. Assessment Strategy

-Practical group class work

-Individual practical course work

-Various assignments and lastly the final examination on the general module

10. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
In-course assessment:		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11. Strategy for feedback and student support during module

- ❖ Each Presentation is marked, marks post on the course Web on the University Online Campus Platform, with immediate feedback (direct contact with the student or contact through the online courses platform);
- ❖ Specimen examination papers and solutions available

12. Indicative Resources

Core Text (include number in library or URL) (inc ISBN)

- Amend, Robert H&Schrader, Micheal A. 1994. Media for business. Knowledge industry publication.
- - Ashley, A. 1993. A handbook of commercial correspondence. Workout Oxford: University press.
- - Burton, SH. 1987. Workout English GCSE. Avon: Macmillan Educational.
- Naterop, Bertha, Weis, Erich and Haberfellner, Eva1996. Business letter for all. Oxford: University press
- Roach, John, M. 1995. Writing better letters, Reports, and Memos. Amacom.
- Sillars, Stuart 1988. Success in communication. London: John Murray.

Key websites and on-line resources

http//:www.ulk-kigali.net/ulkcours

13. Teaching Team

RUDASINGWA Claudien

UWERA SAUDAH

UMUMARARUNGU CHRISTINE

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, Science and Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean,Science& Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 2

1. Module code CSC 102 **SCHOOL:** SCIENCE AND TECHNOLOGY

2. Module Title: CALCULUS I

3. Level: 1 Semester: 1 Credits: 12

4. First year of presentation: **2008** **Administering School:** SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

*** Secondary school**

6. Allocation of study and teaching hours

Total student hours _____	Student hours	Staff **Hours**
Lectures	**40**	**60**
Seminars/workshops	**10**	**10**
Practical classes/laboratory	**20**	**20**
Structured exercises	**10**	**10**
Set reading etc.	**10**	_____
Self-directed study	**10**	_____
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other:		
TOTAL	120	120

6.1 Brief description of aims and content

Calculus I aim at differential calculus and integral calculus to solve scientific problems. It also helps students to gain solid foundation that will be useful to understand computing courses.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students should be able to demonstrate knowledge and understanding of:

1. Differential calculus
2. Integral calculus
3. Fundamentals of integration of functions of one variable
4. Successive Differentiation.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to demonstrate knowledge and understanding of:

5. Generalized Mean value Theorem
6. Orthogonal intersection of curves
7. Euler's Theorem on Homogeneous functions
8. Integration by Parts, by Substitution

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to demonstrate the knowledge of:

9. Definite integrals, length of arc, Area, surface and volumes. Reduction formulae
10. Functions of two variable

iv) General transferable skills

Having successfully completed the module, students should be able to demonstrate the knowledge of:

11. Improper integrals and their convergence, multiple integrals, change of order of integration, Transformation of Co-ordinates, Area, Volume and surface area of solids using multiple integrals.

7. Indicative Content

- Language practice

-The continuous use of the English language in an intensive way

8. Learning and Teaching Strategy

UNIT I: DIFFERENTIAL CALCULUS

CONTENTS

Successive Differentiation. Leibnitz's Theorem. Rolle's Theorem. Lagrange's and Cauchy's Mean value Theorem. Generalized Mean value Theorem. Taylor's and Maclaurin's infinite series. Cartesian and polar substangenent and Subnormal. Pedal equations. Orthogonal intersection of curves. Curvature and radius of Curvature in case of Cartesian parametric, polar, pedal and tangential forms. Centre of curvature and evolute. Indeterminate forms L Hospital's Rule. Concavity, convexity and points of inflexion. Asymptotes (Cartesian Co-ordinates only).

Functions of two variable. Partial derivatives. Euler's Theorem on Homogeneous functions. Its generalization and extension. Total differential and derivatives. Errors and Approximations. Taylor's series in case of two variables. Maxima and Minima of two variables. Lagrange's method of Undetermined multipliers in case of two and three variables. Jacobians. Envelope of curves. Tangent planes and Normal lines.

UNIT II: INTEGRAL CALCULUS I

CONTENTS

Fundamentals of integration of functions of one variable. Integration of Elemental Functions. Integration by Parts, by Substitution. Integration of Rational Functions, Partial Fractions. Definite integrals, length of arc, Area, surface and volumes. Reduction formulae. Improper integrals and their convergence, Multiple integrals, change of order of integration, Transformation of Co-ordinates, Area, Volume and surface area of solids using multiple integrals.

9. Assessment Strategy

-practical group class work

-Individual practical course work

-Various assignments and lastly the final examination on the general module

10. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11. Strategy for feedback and student support during module

Correction in class of written in-course tests, assignment, exercises, discussion in group work for case studies given before to students allow them to mustering the course very well.

12. Indicative Resources

Core Text (include number in library or URL) (inc ISBN)

1. Bittinger, Marvin L., Ellenbogen, David J., Surgent, Scott Adam **[***2009*] *Calculus and its applications10th Edition,* Addison Wesley
2. Hughes-Hallett, Deborah, Hallett, Deborah Hughes [2008] *Calculus: Single and multivariable*, Wiley, John & Sons, Incorporated
3. Stewart, James, [2009] Essential Calculus Early Transcendentals, Thomson Learning.

13. Teaching Team

Dr KARAMBIZI Sylvestre

TWAGILIMANA Cyprien

NAHIMANA Godefroid

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, Science and Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 3

1. Module code CSC 103 **SCHOOL:** SCIENCE AND TECHNOLOGY

2. Module Title: FUNDAMENTALS OF ELECTRICITY AND ELECTRONICS

3. Level: 1 Semester: 1 Credits: 12

4. First year of presentation: 2008 **Administering School:** SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

CSC102 Calculus 1

6. Allocation of study and teaching hours

Total student hours: 120	**Student Hours**	**Teacher's load**
Lectures	**40**	**60**
Seminars/workshops	**10**	**10**
Practical classes/laboratory	**20**	**20**
Structured exercises	**10**	**10**
Set reading etc.	**10**	**-**
Self-directed study	**10**	**-**
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other (Invigilation, Marking)		
TOTAL	120	120

6.1 Brief description of aims and content

Electronics is a field of engineering and applied physics dealing with the design and application of devices, usually electronic circuits, the operation of which depends on the flow of electrons for the generation, transmission, reception and storage of information.

The information can consist of voice or music (audio signals) in a radio receiver, a picture on a television screen or numbers and other data in a computer.

Students are introduced to different electronic parts and their functions and how to care for, handle and assemble the parts to form electronic systems. Students build actual circuits and see and measure the effects that the different components have on the electrical circuits. As many electronic systems use decision-making, students are introduced to basic programmable logic controllers.

Electronics empowers students to learn about the sophistication of advance technology in telecommunications and information technology.

As well, this module contains trade specific skills, knowledge, attitudes and values for the students to understand how electricity is applied in practice.

6.2 Learning Outcomes

a) Knowledge and Understanding

On completion of the module, students should have knowledge and understanding to:

1. Explain atomic theory in terms of electrical materials
2. Explain electron flow in a conductor with reference to electron theory
3. Explain the effect of an external power source on electrons in a conductor with reference to electron theory
4. Explain the principles of basic electrical circuits in terms of power source and load
5. Explain the basic principles of voltage and current flow in an electrical circuit in terms of electron theory. The concept of permanent magnet in terms of the molecular structure of materials.
6. Explain the effect of heat on semiconductor materials in relation to their conductivity characteristics
7. Draw and explain the structure of an atom in the context of basic electron theory.
8. Explain the free electron in the context of electron theory principles.

b) Cognitive/Intellectual skills/Application of Knowledge

On successful completion of the module, the students should be able to:

9. Identify and apply the electrical units and symbols in accordance with SI units
10. Explain the relationship between voltage, current and resistance in terms of Ohm's law
11. Explain the factors influencing resistance in terms of material type, length, diameter and temperature.

12. Calculate the power consumed by a simple resistive electrical circuit in terms of DC theory.

c) Communication/ICT/Numeracy/Analytical Techniques/Practical Skills

On completion of this module, students will be able to demonstrate the following skills:

13. Draw and interpret series, parallel and series-parallel circuits according to instructions
14. Calculate and interpret resistance, voltage, current and power variances in series circuits according to instructions
15. Calculate and interpret resistance, voltage, current and power variances in parallel circuits according to instructions
16. Calculate and interpret resistance, voltage, current and power variances in series-parallel circuits according to instructions
17. Handle measuring instruments.

d) General transferable skills

On completion of this module, students should be able to:

18. Identify, explain the concepts of electricity and electronics in any particular situation, including real life situations.
19. Communicate concepts and principles of electricity and electronics concisely, accurately and informatively to specialist and non-specialist audiences.
20. Work independently and in collaboration with colleagues as needed.
21. Have the confidence to advance and extend knowledge through development of an independent learning ability and personal responsibility.

7. Indicative Content

DC Circuits: Concepts of electric current, Ohm's law, resistance, conductance, resistivity, conductivity, power, energy, Kirchoff's voltage and current laws and their application in simple DC circuits, Mesh and Node methods of analysis, circuits theorems: Thevenin, Norton, Superposition, maximum power transfer theorems, application of network theorems in solving DC circuit problems.

AC Circuits: Concepts of Alternating current, generation of AC voltage, equations of sinusoidal waveform, instantaneous, average and RMS value, response of R, L and C elements, active, reactive power and power factor. RL circuits, RC circuits, RLC circuits, series and parallel resonance.

Semiconductor Devices: Passive electronic components, semiconductor materials, semiconductor diode, zener diode, diodes applications: Half-wave rectification, full-wave rectification, bridge rectifier, voltage stabilization and voltage regulation. Bipolar Junction Transistor (BJT): transistor action, transistor as an amplifier, transistor configurations: common

base configuration, common emitter configuration, common collector configuration, transistor biasing, operating point, D. C load line.

The course uses a combination of lectures, demonstrations, discussions, and hands-on labs.

8 Learning and Teaching Strategy

Basic knowledge and understanding are developed in computer practicals which contain discussion elements based on problem examples that are intended to stimulate students to research topics of interest. Skills development takes place using self-directed computer practicals based on problem themes and examples where the knowledge and understanding may be applied.

The computer practicals contain some worked examples and more presented as non-assessed exercises which are then discussed in class. The exercises are intended to reinforce the practical material. Practical notes provided on the website and hard copies and so are problem sheets for practical exercises.

9 ASSESSMENT STRATEGY

(i) Learning outcomes are evaluated using a 2 hours end of semester examination.
(ii) Self-directed learning is evaluated by giving the students practical exercises that they will discuss in groups; solve and present during laboratory practicals
(iii) The use of appropriate referencing is evaluated in written assignments (TP)
(iv) The ability to communicate effectively using mathematical language in a variety of forms (symbols, graphs, diagrams, planes language) and to work in teams is evaluated by a group assignment where groups present prescribed topic to their peers in practical context. The presentation and accompanying reports are evaluated by the lecturer and peer assignment is used.

10 ASSESSMENT PATTERN

Component	Weighting (%)	Learning objectives covered
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11. STRATEGIES FOR FEED-BACK FROM STUDENTS AND FOR ENABLING THEM ATTENDING CLASSES

- Examples and exercises/specimen practicals in each weekly set of self-study notes, with solutions provide self-assessment.
- Each practical assignment is marked with immediate feedback
- Specimen examination papers and solutions available

12. PROPOSED REFERENCES

Core Text

- A. S. Sedra and K. C. Smith, *Microelectronics Circuits* 4th Edition, Saunders College Publication, 1998.
- Stanley G. Burns and Paul R. Bond, Principles of Electronics, 2nd Edition PWS Publishing Company, 1997.
- Alonso M. and Finn E.J., [1983]Fundamental University Physics, Vol. 2, Addison Wesley Publishing Company ,ISBN 0 – 201 – 00162 - 400162
- Feynman R.P., Leighton R.B. and Sands M. [1963], The Feynman Lectures on Physics, Vols. II, Addison Wesley Publishing Company. ISBN 0 – 201 – 02117 – X

Background Texts

- Arora C.L., [2001]Refresher course in B.Sc. Physics, Vol. II, S. Chand and Company. ISBN 81-219-0466-8
- Purcell E.M., [1985]. Berkeley Physics Course, Vol. 2, Electricity and Magnetism, McGraw-HillISBN 0-07-004908-4
- Irodov I.E., [1981] Problems in General Physics, Mir Publishers. ISBN 5-03-000800-4.

- Reitz J.R., Milford F.J., Christy R.W, , [1993] Foundations of Electromagnetic Theory, Addison Wesley,. ISBN 0-201-52624-7
- Springer-Verlag [1998]. Laboratory Experiments in College Physics, ISBN 3-540-64124-6
- Rees W.G., [1996] Physics by Examples, Cambridge University Press. ISBN 0-521-56697-5

Journals

- Physics Education, Institute of Physics Publishing, UK.
- American Journal of Physics, American Association of Physics Teachers, USA.
- Physics Today, American Institute of Physics, USA.
- The Physics Teacher, American Association of Physics Teachers, USA.

Key websites and on-line resources

- http://physics web.org/resources/home
- http://www.allaboutcircuits.com
- http://www.physicsclassroom.com

Teaching/Technical Assistance

1 Tutorial Assistant is required.

Laboratory space and equipment

At present, we have some equipment, but some more are required.

13. Teaching Team

Mr. KAGARAMA John Baptist

Mr. UWITONZE Alfred

Mr. NAHIMANA Godefroid

Mr. TWAGILIMANA Cyprien

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 4

1. Module Code: CSC 104 **SCHOOL:** SCIENCE AND TECHNOLOGY

2. Module Title: INFORMATION TECHNOLOGY

3. Level: 1 Semester: 1 Credits: 12

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisites:

6. Allocation of study and teaching hours

Total student hours: 120	**Student Hours**	**Teacher's load**
Lectures	**40**	**60**
Seminars/workshops	**10**	**10**
Practical classes/laboratory	**20**	**20**
Structured exercises	**10**	**10**
Set reading etc.	**10**	**-**
Self-directed study	**10**	**-**
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other (Invigilation, Marking)		
TOTAL	120	120

6.1 Brief description of aims and content

This course of study identifies the essential knowledge and skills that computer science students need to be active lifelong learners in an information technology intensive environment. The curriculum is designed to form the foundation for continuous learning and to be applicable to ever changing innovations. The computer skills standard course of study involves the

development of skills over time. These skills become building blocks with which to meet the challenges of personal and professional life.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students will be able to demonstrate knowledge and understanding of:

I.1 The concepts of stored program in digital computer,

I.2 The concepts and fundamentals of operating systems.

I.3 Methods and techniques in which computers can be used efficiently and effectively in the day to day applications.

I.4 Ms-Windows Operating System

I.5 Application software like Ms-Word, Ms-Excel, Ms-Power point, Ms-Access, Internet Explorer etc.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

II.1 Describe various input and output devices and their role in computer.

II. 2 Apply the knowledge of learnt application software in daily life activities by using word processing, worksheets, presentations, database management systems and Internet tools.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students will be able to:

III.1 Demonstrate theoretical and Practical skills in Computer Science.

III.2 Solve minor computer problems related to both hardware and software.

iv) General transferable skills

Having successfully completed the module, students should be able to:

IV. 1 Search study material using computers and internet.

V. 2 Complete their assigned task under tough time constraints.

IV. 3 Be self contained to perform their assigned responsibility independently or with little guidance.

IV. 4 Be self-employed by applying learnt knowledge.

7. Indicative Content

Introduction to computers, Windows Operating Systems, Word Processing: case of Microsoft Word, Spreadsheet Management: case of Microsoft Excel, Database Management Systems: case of Microsoft Access, Presentation Software: Case of Microsoft PowerPoint, Internet applications.

8. Learning and Teaching Strategy

The role of the lecturer is to be a facilitator. He must be always at the level of knowing what the student has understood about the subject taught. He must give clarifications so that students are able to go for research of more details. Lecturer has to give more assignment, group work and homework to students. He must try always to give case studies to students to let them digest well the subject and to know how to apply it to real life. Because of the system of students centred learning more Seminars and practical are given to students.

9. ASSESSMENT STRATEGY

- Teacher may ask students to prepare computerized presentations to encourage students to use ICT in education.
- Teacher may ask students to make their own research about particular topic using library resources or internet and then produce computerized report. These reports can be assessed formatively to give feedback to students
- Alternatively some of the assessment tools mentioned above can be used by teacher to award marks and record them for administrative purposes as summative assessment.
- There will be comprehensive final examination (Paper-Pencil test) to give score to each student and record them for administrative purpose.

10. ASSESSMENT PATTERN

Component	**Weighting (%)**	**Learning objectives covered**
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11. Strategy for feedback and student support during module

Correction in class or in computer laboratory of written in-course tests, assignment, exercises and laboratory exercises, discussion in group work for case studies given before to students allow them to mustering the course very well.

12. Indicative Resources

Core texts

- Shelly, B. Gary, *Microsoft Office 2000 : Introductory concepts and techniques*, 005.3 SHE 2001
- Bradley, Anne-Mariem, *Internet technologies : stage I award for OCR, making the internet work for you*, 004.678 BRA 2002
- Patrick K. Kagoda, Waburoko, E. S. , *Computers : An Introduction to Information Technology* 004 WAB 2000

Background Texts

- Bride , Mac, *The Internet*, 004.678 BRI 2001
- Donnellan, Craig , *The impact of the Internet*, 004.678 DON 2002
- Hutchinson,Sarah E, *Microsoft word 2000*, 005.52 HUT 2000
- Spencer, Sharon, *Text production and word processing with Mailmerge : Endorsed by OCR for the certificates in text processing*, 005.52 SPE 2004
- Wyatt, Rosemarie, *Word processing for office XP : Level 1 certificate for IT users for city & guilds,* 005.52 WYA 2004
- Hutchinson, Sarah E, *Microsoft Excel 2000*, 005.54 HUT 2000
- Stephen, Moira, *Excel 2000*, 005.54 STE 1999
- Moira, Stephen, *Excel 2003*, 005.54 STE 200
- Ward, Susan, *Spreadsheets*, 005.54 WAR 2003
- Hutchinson, E. Sarah, *Microsoft Powerpoint 2000*, 005.58 HUT 2000
- Grimes, A. Galen, *The Internet and the World Wide Web*, 004.6 GRI 1996
- Kraynak , Joe, *Internet 6 in 1*, 004.6 KRA
- Waburoko, E.S, *Computer: An introduction to information technology,*, 2000.

- Melys, Fred, *Internet : les meilleures astuces*,
- Grauer, Robert T, *Exploring brief Microsoft Office 2000 professional*, 1999
- Grauer, T. Robert, *Exploring Microsoft excel 2000*, 1999
- Grauer, T. Robert, *Exploring Microsoft Office 2000 Professional*, 1999 4
- Microsoft PowerPoint : *The most popular presentation graphics program Version* 4.0,1993

Journals

- http://www.springerlink.com/ online journal
- http://ieeexplore.ieee.org/ online journal

Key websites and on-line resources

http://www.softlookup.com/tutorial/

http://www.freetechbooks.com/

https://www.lulu.com/commerce/index.php

Teaching/Technical Assistance

- 2 Lab Attendant

Laboratory space and equipment

- One Server and at least 80 client computers in Computer Lab connected together with LAN.
- Students require weekly 4 hours Hands-on-practice in Computer Lab.
- LCD Projector for routine lectures and seminars, whiteboard, marker pens.
- Weekly 10 Internet hours are required for staff as well as students to access online study material.

Computer requirements

MS-Windows Operating System, Ms-Office software together with multiple licenses for educational purposes for practical classes, preparation of lecture notes, assignments and presentations.

13. TEACHING TEAM

TWAGILIMANA Cyprien (Module Leader)

NDASHIMYE Emmanuel (Member)

NAHIMANA Godefroid

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the program to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 5

1. Module code CSC 105 **SCHOOL:** SCIENCE AND TECHNOLOGY

2. Module Title: INTRODUCTION TO COMPUTER SCIENCE

3. Level: 1 Semester: 1 Credits: 12

4. First year of presentation: __**2008**_ **Administering School:** SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

CSC104-INFORMATION TECHNOLOGY

6. Allocation of study and teaching hours

Total student hours: 120	**Student Hours**	**Teacher's load**
Lectures	**40**	**60**
Seminars/workshops	**10**	**10**
Practical classes/laboratory	**20**	**20**
Structured exercises	**10**	**10**
Set reading etc.	**10**	**-**
Self-directed study	**10**	**-**
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other (Invigilation, Marking)		
TOTAL	120	120

6.1 Brief description of aims and content

This module aims to equip students with general programming principles and programming constructs of C language which can help them to make real life programs.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students will be able to demonstrate knowledge and understanding of:

i. How to write and debug programs using an IDE
ii. The principles of designing structured programs
iii. When and how to use the appropriate statements available in the C language
iv. Both Theoretical and Practical concept in programming using high level programming languages.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students will be able to:

v. Use various Programming language construct available in C
vi. Explain the principles of structured program design
vii. Describe when and how to use the stand C statement

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students will be able to:

viii. Write, Compile and Debug basic C programs using an IDE
ix. Develop programs or applications to solve problems in many areas (numerical analysis, artificial intelligence, Computer Networks, etc)

iv) General transferable skills

Having successfully completed the module, students should be able to:

x. Implement and verify various programming logic concepts learnt before from a real programming interface
xi. Solve model problems using C language

7. INDICATIVE CONTENT

Unit I: Programming principles

Programming concepts:Introduction,Terminologies,Data type,Data representation,Stages in program Development.Number system:Algorithm:Introduction,Why study algorithm design,Issues in Algorithm Design,Pseudo-code,Flowchart,Symbols used in flowchart,Guidelines in flowcharting,Advantages of using flowcharts,Limitations of using flowcharts.Program Structure:Variable,Variable Declaration,Constants,Boolean Algebra,The Boolean Operators,Comparison Operators,Mathematical operator,Combining Boolean and Comparison Operators,

Unit II: C programming

Introduction, writing, compiling and executing a simple C Program. Variables and Constants Declaration, types and memory consumption. Directives in C - #define, #include. Simple I/O Functions - getchar, putchar, printf, scanf formatted I/O statements. Operators and expressions. Managing input/output operations. Decision making branching and looping. Arrays. Handling of character strings. User defined functions. Pointers, Structures, Memory management. Files, Pre-processors.

8. LEARNING AND TEACHING STRATEGY

Lectures will introduce the concepts of structured programming. They will also describe some of the practical aspect of C programming. The Laboratories assessments will be supervised by a tutor. Students will try to work sometimes independently and in group to let them digest the problem and to owner the understanding.

9. ASSESSMENT STRATEGY

Formative and summative assessments are organized.

In-course assessment composed of written test, assignment or homework and handled practical assignment must be organized. Students have to receive comments on their works and results where it is needed.

In-course assessment counts for 40% of the whole course marks while the final examination of 2 h 30’ duration will count for 60% and cover the whole content.

10. ASSESSMENT PATTERN

Component	**Weighting (%)**	**Learning objectives covered**
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11. STRATEGY FOR FEEDBACK AND STUDENT SUPPORT DURING MODULE

During the lectures, there may be quizzes and discussions in groups with a plenary feedback. Participation will be encouraged. The corrections of laboratories exercises will be done in labs or in classes.

12. INDICATIVE RESOURCES

Core texts

- Brian W.Kernighan and Dennis M.Ritchie,[1988] *The C programming Language, Second edition*, Prentice Hall.
- Clovis L. Tondo and Scotte E. Gimpel,[1989] *The C Answer book ,Second edition,* Prentice Hall.
- Ritchie, M. Dennis, [2000]*The C programming language*, 005.33 KER 2000

Background Texts

- (Hervey and Paul) Deitel and Associates, [2007] *C how to program, Fifth edition,* Prentice Hall.
- Ritchie, M. Dennis,[2000] *The C programming Language*.
- Uckan, Yuksel,[1999] *Problem solving using C: Structured programming Techniques*.

Key websites and on-line resources

http://www.softlookup.com/tutorial/

http://www.freetechbooks.com/

https://www.lulu.com/commerce/index.php

13. TEACHING TEAM

Mr. KAGARAMA J. Baptist (Team leader)

Mr. NIYIKIZA Gaston (member)

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the program to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 6

1 Module Code: CSC 106**.....School:** SCIENCE AND TECHNOLOGY

2 Module Title: ETHICS, RWANDAN CULTURE AND CIVIC EDUCATION

3 **Level: I Semester: 2 Credits: 12**

4 First year of presentation: **2008** **Administering School:** SCIENCE AND TECHNOLOGY

5 Pre-requisite or co-requisite modules, excluded combinations

*** YEAR 1 SEMESTER 1 ENGLISH COMMUNICATION SKILLS IN ENGLISH MODULE**

6. Allocation of study and teaching hours

Total student hours _____	**Student hours**	**Staff hours**
Lectures	**35**	**45**
Seminars/workshops	**25**	**45**
Practical classes/laboratory	**10**	**-**
Structured exercises	**10**	**10**
Set reading etc.	**10**	**----------**
Self-directed study	**10**	**----------**
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other:		
TOTAL	120	120

6.1 Brief description of aims and content (not more than five lines)

This module is made of the following units: Ethics, Rwandan Culture and Civic Education and the unit of Contemporary History of Africa and the History of Rwanda.

It focuses particularly on:

* How to behave

* To get knowledge

* To acquire technical know-how

Civic education

* To know the history of Rwanda and the contemporary history of Africa

The general objective of this course is to sensitize the students of this university to become real cadres of change for better life (at individual, family, community, national and international levels).

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students should be able to demonstrate knowledge and understanding of:

- theoretical considerations on morals, ethics, body, soul and spirit ; moral conscience, culture, civic education,
- principles of a happy life
- ethics and business
- ethics and science
- Rwandan culture and civic education of the pre-colonial, colonial and post-colonial periods
- Rwandan culture and civic education in post genocide period
- Contemporary history of Africa and the history of Rwanda.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

5. Analyse some ethical issues
6. Know how to behave, to get knowledge and to acquire technical know-how
7. Distinguish ethics from morals, and moral conscience
8. Stimulate moral sensitivity and responsibility
9. Show attitudes of tolerance in case of discordance between him/her and another person and to stand firmly vis-à-vis incoherence and anti-values.
10. Make a critical judgement on elements of other cultures proposed to our society
11. Liberate himself and liberate others from ethnic, regional et ideological prejudices and spread out ethical values
12. Know different programs of the government of Rwanda
13. Know the history of Rwanda and contemporary Africa

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

- Show good behaviors of ethical values of integrity, justice, peace and tolerance
- Be actor or cadre of change for a better life in his/her family, community, national and international levels
- Participate to the government policy development and implementation
- Tale the real history of Rwanda and of the contemporary Africa

iv) General transferable skills

Having successfully completed the module, students should be able to:

14. apply or implement the principles of a happy life they have learned in their day-to-day lives in the family, community, the country and abroad
15. Participate and contribute to actions initiated by different organisations (public and private) which aim to fight against anti-values, conflicts, genocide, etc.
16. Help others be characterised by values of integrity, tolerance, justice, and peace.
17. Advise and inform others about principles of living a better life.

7. Indicative Content

PART 1: ETHICS, RWANDAN CULTURE AND CIVIC EDUCATION

UNIT OBJECTIVES

CHAPTER I: THEORETICAL CONSIDERATIONS

CHAPTER II: PRINCIPLES OF A HAPPY LIFE
CHAPTER III: ETHICS AND BUSINESS

CHAPTER IV: ETHICS AND SCIENCES

CHAPTER V: RWANDAN CULTURE AND CIVIC EDUCATION OF THE PRE-COLONIAL PERIOD

CHAPTER VI: RWANDAN CULTURE AND CIVIC EDUCATION OF THE COLONIAL PERIOD

CHAPTER VII: RWANDAN CULTURE AND CIVIC EDUCATION OF POST6COLONIAL PERIOD

CHAPTER VIII: RWANDAN CULTURE AND CIVIC EDUCATION: POST GENOCIDE PERIOD

PART 2: HISTORY OF RWANDA

UNIT OBJECTIVES

CHAPTER I: THE PRECOLONIAL PERIOD OF RWANDA

CHAPTER II: THE COLONIAL PERIOD OF RWANDA

CHAPTER III: THE POST-COLONIAL PERIOD OF RWANDA

8. Learning and Teaching Strategy

At the beginning the teaching strategy is expositive but the main part of the course that follows is essentially of active method. The lecturer will explain the content of the course to the students in order to acquaint them with enough skills and sensitize them to become real cadres of change for better life at individual, familial, community, national and international levels. Then at

the end of every chapter student will make groups work, they will collectively discuss and answer the questions prepared and written at the end of each chapter. Every group will present its assignment and the lecturer will help better understand. Face to face lectures, including discussions based on examples that are intended to help student well understand will be encouraged.

9. Assessment Strategy

Learning Outcomes will be evaluated gradually after each unit. An examination of duration of 3 hours will be prepared and they will sit for it. Assignments and presentations of students groups work will be marked too.

10. Assessment Pattern

Component	**Weighting (%)**	**Learning objectives covered**
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11. Strategy for feedback and student support during module

- The final test or examinations, presentations on structural exercises and assignments will be marked. Students' marks will be registered and available on the web site of ULK. Students' marks will be copied on the transcripts that will be sticked up.
- The questions and answers for the exam will be available at the web site of the university.

12. Indicative Resources

Core Text (include number in library or URL) (inc ISBN)

1. ANSALDI, Jean : *Ethique et sanctification*, 1983
2. BONHOEFFER, Dietrich : *Ethique*, 1965
3. BRACKMAN, Colette : *Histoire d'un génocide*, 1995
4. CHRETIEN, Jean Pierre : *Rwanda, les medias du génocide*, éditions KARTHALA, Paris, 1995
5. CROUSSE, Bernard et ROUBAN, Luc : *Progrès scientifique et débat éthique*, 1989
6. KAGAME, Alexis : *Un abrégé de l'histoire du Rwanda de 1853à1972*, 1975
7. KANYAMACUMBI Patient : *Société, culture et pouvoir politique en Afrique inter lacustre, Hutu et Tutsi de l'ancien Rwanda*, 1995
8. MISSER François : *Vers un nouveau Rwanda, entretiens avec Paul Kagame*, éditions Karthala, Juin 1995

9. WARREN, Rick : Une vie motivée par l'essentiel, 2006, translation from the purpose driven life, 2002, Purpose Driven Ministries, California, USA
10. LOVELL, Alan: Business Ethics and Values, 2006, Prentice Hall.

Key websites and on-line resources

http//:www.ulk-kigali.net/ulkcours

Laboratory space and equipment

The computer and internet rooms of the university will be utilized for personnel researches and students' assignments

Computer requirements

A Laptop (computer) and A projector will be used while teaching this module.

13. Teaching Team

Prof. Dr. RWIGAMBA BALINDA

SETUZA Friend

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 7

1. Module code CSC 107 **SCHOOL:** SCIENCE AND TECHNOLOGY

2. Module Title: CALCULUS II

3. Level: 1 Semester: 2 Credits: 12

4. First year of presentation: __**2008**_ **Administering School:** SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

CSC102-CALCULUS I

6. Allocation of study and teaching hours

Total student hours: 120	**Student Hours**	**Teacher's load**
Lectures	**40**	**60**
Seminars/workshops	**10**	**10**
Practical classes/laboratory	**20**	**20**
Structured exercises	**10**	**10**
Set reading etc.	**10**	**-**
Self-directed study	**10**	**-**
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other (Invigilation, Marking)		
TOTAL	120	120

6.1 Brief description of aims and content

This module helps the students to be able to apply calculus of several variables to solve problems of optimization, differential geometry and physics.

6.2 Learning Outcomes

i) Knowledge and Understanding

Upon completion of this module the students will be able to:

1. Solve double integrals
2. Solve double Integrals over Rectangles
3. Solve double Integrals over General Regions
4. Solve double Integrals in Polar Coordinates
5. Know the Applications of Double Integrals

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

6. Solve Triple Integrals
7. Solve Triple Integrals in Cylindrical Coordinates
8. Solve Triple Integrals in Spherical Coordinates
9. Know the Change of Variables in Multiple Integrals

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

10. Construct and present mathematical arguments with accuracy and clarity.

iv) General transferable skills

Having successfully completed the module, students should be able to:

11. Appreciate data analysis, and have the knowledge of how to select and interpret an appropriate method of Linear Algebra.
12. Understand the use of mathematics, and an assimilation of mathematical theory studied outside this module into a linear framework.

7. Indicative Content

UNIT I: INTEGRAL CALCULUS II

Double integrals, Double Integrals over Rectangles, Double Integrals over General Regions, Double Integrals in Polar Coordinates, Applications of Double Integrals

UNIT II: INTEGRAL CALCULUS III

Triple Integrals, Triple Integrals in Cylindrical Coordinates, Triple Integrals in Spherical Coordinates, Change of Variables in Multiple Integrals

8. Learning and Teaching Strategy

The role of the lecturer is to be a facilitator. He must be always at the level of knowing what the student has understood about the subject taught. He must give clarifications so that students are able to go for research of more details. Lecturer has to give more assignment, group work and homework to students. He must try always to give case studies to students to let them digest well the subject and to know how to apply it to real life. Because of the system of students centred learning more Seminars and practical are given to students.

9. Assessment Strategy

- Teacher may ask students to prepare presentations to encourage students to make they own research.
- Teacher may ask students to make their own research about particular topic using library resources or internet and then produce report. These reports can be assessed formatively to give feedback to students
- Alternatively some of the assessment tools mentioned above can be used by teacher to award marks and record them for administrative purposes as summative assessment.
- There will be comprehensive final examination (Paper-Pencil test) to give score to each student and record them for administrative purpose.

10. Assessment Pattern

Component	**Weighting (%)**	**Learning objectives covered**
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11. Strategy for feedback and student support during module

Correction in class of written in-course tests, assignment, exercises, discussion in group work for case studies given before to students allow them to mustering the course very well.

12. Indicative Resources

1. Flath, Daniel E., Gleason, Andrew M., Gordon, Sheldon P. [2009] *Applied Calculus*, Wiley

2. Apostol, Tom M. [2008] *Calculus*, John Wiley & Sons Inc

3. Salas, Satunino L., Etgen, Garret J., Hille, Einar [2006] *Calculus One and Several Variables*, John Wiley & Sons Inc

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 8

1. **Module Code:** ___CSC 108 **SCHOOL:** SCIENCE AND TECHNOLOGY
2. **Module Title:** COMPUTER HARDWARE TECHNOLOGY
3. **Level: 1 Semester: 2 Credits: 12**
4. **First year of presentation: 2008 Administering School:** SCIENCE AND TECHNOLOGY
5. **Pre-requisite or co-requisite modules, excluded combinations**

CSC 103: Fundamentals of Electricity & Electronics.

CSC 104: Information Technology.

CSC 105: Introduction to Computer Science

6. Allocation of study and teaching hours

Total student hours : 120	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**24**	**24**
Structured exercises	**18**	**18**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**6**	**6**
Examination – revision and attendance	**12**	**12**
Other: (Invigilation & Marking)		
TOTAL	**120**	**120**

6.1 Brief description of aims and content

In this module students learn about personal computer hardware and operating system Software. Practical experience will be gained in the maintenance and repair of both the Computers hardware and its key software components.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students should be able to demonstrate knowledge and understanding of:

Having successfully completed the module; students should be able to demonstrate knowledge and understanding of:

i. Identify the main components in a personal computer
ii. Describe the function of these components
iii. Demonstrate how to remove and install these components
iv. Installation, configuration & upgrading of OS and application
v. Be able to install and repair the computers operating system and remove both viruses and malware.
vi. Diagnosing, troubleshooting and preventive maintenance

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should develop the following cognitive skills:

vii. The Ability of describing computer hardware parts by seeing them within computer's case cabinet.
viii. The Ability of combining and removing Computer's hardware parts
ix. The Ability of starting a Computer system and prepare it for software installation.
x. The Ability of Installing different types of software packages to start, maintain, and use Computer System.
xi. The Ability of knowing various software packages depending on the type of computer system being used.
xii. The Ability of doing maintenance for the software of Computer System by detecting, locating, and recovering from various software faults.
xiii. The Ability of doing maintenance for the hardware of Computer System by detecting, locating, and recovering from various hardware faults.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

xiv. Analyze needs of an organization and further suggest a suitable computer system solution.
xv. Work out hardware and software requirements to construct a computer system.
xvi. Disassemble and assemble computer system at various levels.
xvii. Dealing with both hardware and software troubles.

iv) General transferable skills

Having successfully completed the module, students should be able to Share skills in those studied courses.

7. Indicative Content

UNIT ONE: COMPUTER HARDWARE FUNDAMENTALS

Microprocessors: Intel family of microprocessor, microprocessor specifications, Microprocessor Architecture, ALU, Control Unit, Registers

Semiconductor Memories: Memory Terminology and General Operation, ROM and its Architecture, Types and Applications of ROM, Semiconductor RAM, SRAM, DRAM

Secondary memory: Magnetic memories, Optical Memories, Formatting and partitioning Hard disks

System Buses: standard buses – IEEE RS – 232, PCI, ISA and EISA. CMOS setup, Introduction to firmware (BIOS).

Basic Cards: IDE and SCSI cards, VGA, EGA and SVGA cards, Network cards Ethernet specifications, Interfacing devices and DMA, IRQ, resolving IRQ conflicts

Power Devices: SMPS, CVT and UPS.

UNIT II: COMPUTER TROUBLESHOOTING & MAINTENANCE

CONTENTS

Motherboard Identification, ROM and BIOS Chips Identification, Computer Expansion Slots identification, RAM and RAM Sockets Identification, The Computer Case and Power Supply, Motherboard Installation, Floppy Drive, Hard Drive, and CD-ROM Installation, Video Card Installation and System Booting, Basic DOS Commands, Creating a DOS Boot Disk, Hard Drive, Preparation Using FDISK and FORMAT, Windows OS Installation, Windows Start up Disk, Sound Card Installation, Creating an Emergency Repair Disk, Installation Demonstration of Windows 2000, Assigning Permissions in Windows 2000, Creating Users Accounts in Windows 2000 and XP, Adding an Printer to Your Computer, Using the Scandisk and Defrag Utilities, Identifying POST Errors, Booting into Safe Mode, Using the Windows 2000 Recovery Console, Windows Registry Backup and Recovery, Safe Handling and Use of a multi meter, Voltage and All electronic Component checking, Soldering De soldering Components, Problem identification and Troubleshooting – Printer, Monitor, UPS, Scanner, SMPS. Floppy Drive, CD-ROM, Data Recovery and Password recovery, Installation of CD drives, system protection from Viruses, basic Troubleshooting.

8. Learning and Teaching Strategy

- Teacher introduces available Computer hardware in the lab and demonstrates practically disassembling and assembling the computer system.
- Seminar/workshop, quiz, debate competitions will be organized and students will be encouraged to participate subject to resource availability.
- Students will discuss the concepts in peer groups during informal conversation and share knowledge.

9. ASSESSMENT STRATEGY

- Students may be asked to work on short-term computer hardware and /or software projects in which students plan and physically implement a computer system on his capability.
- Teacher may ask students to make their own research about particular topic using library resources or internet and then produce computerized report. These reports can be assessed formatively or can be awarded as continuous assessment.
- There will be comprehensive final examination to give score to each student and record them for administrative purpose.

10. ASSESSMENT PATTERN

Component	**Weighting (%)**	**Learning objectives covered**
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11. Strategy for feedback and student support during module

Students will be given feedback for formative assessments to tell them how they are progressing in terms of knowledge, skills and understanding of a subject. Feedback will be given to the students either during or after the assessment.

12. Indicative Resources

Core Text

- B. RAM, *Fundamentals of microprocessors and microcomputers*, Dhanpat Rai Publications (p) ltd, 5th revised and enlarged edition.
- PC Upgrade and Repair Bible*, Barry Press and Marcia Press,* 3rd Edition, Pearson Education, ISBN 81-265-01065-5

Journals

- http://www.springerlink.com/ online journal
- http://ieeexplore.ieee.org/ online journal

Key websites and on-line resources

http://www.cisco.netacad.net/

Teaching/Technical Assistance

The ULK HARDWARE Lab, Lecturer and One Lab Attendant will be required for Computer Practices on Presentations Techniques as well as on Performance Analysis and Practical Assignments.

Laboratory space and equipment

- (1.5mx2.5m) tables
- 10 toolsets (screw drivers)
- 10 digital multi meters
- 10 Power extension sockets
- 10 complete defective computers
- 10 complete working computers.
- 10 operating system and application programs CD for Windows XP, Windows Vista, Windows 7, Linux, Ms office 2007,any freeware Antivirus such as Avira antivirus each.
- Internet connection.

13. Module Team

Mr. NAHIMANA GODEFROID, Module Leader

Mr. KAGARAMA JOHN BAPTIST

Mr. TWAGILIMANA CYPRIEN

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the program to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 9

1 Module Code: ..... CSC 109..... **School:** SCIENCE AND TECHNOLOGY

2. **Module Title**: COMPUTER PROGRAMMING

3. Level: 1 Semester: 2 Credits: 12

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

CSC105-INTRODUCTION TO COMPUTER SCIENCE

6. Allocation of study and teaching hours

Total student hours: 120	**Student Hours**	**Teacher's load**
Lectures	**40**	**60**
Seminars/workshops	**10**	**10**
Practical classes/laboratory	**20**	**20**
Structured exercises	**10**	**10**
Set reading etc.	**10**	**-**
Self-directed study	**10**	**-**
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other (Invigilation, Marking)		
TOTAL	120	120

6.1 Brief description of aims and content

In this module, students will learn basics of programming with c++, structured and Object Oriented Programming Concepts. They will learn how data abstraction, reusability, inheritance and modularity of code can be enhanced using C++.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module; students should be able to demonstrate knowledge and understanding of:

i) Theoretical and practical programming concepts
ii) Object Oriented concepts and their implementation in C++
iii) Basics data structures using C++.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

iv) write computer program in C++ language
v) write computer program in Java language

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

vi) Present their ideas to a general audience using reasonable written and oral communication skills.
vii) Use numerical and statistical methods to solve Computational problems.

iv) General transferable skills

Having successfully completed the module, students should be able to:

viii) Demonstrate managerial skills
ix) Justify the importance of team sprit to solve a common problem.
x) Be self contained to perform assigned tasks independently or with little guidance.
xi) Complete their assigned task under tough time constraints.

7. Indicative Content

UNITI: C++ PROGRAMMING

CONTENTS

C++ Basics, Flow of Control, Function Basics, Parameters and Overloading, Arrays, Structures and Classes, Constructors, Operator Overloading, Friends, and References, Strings, Pointers and Dynamic Arrays, Separate Compilation and Namespaces, Streams and File I/O, Inheritance, Polymorphism and Virtual Functions, Templates, Linked Data Structures, Exception Handling, Standard Template Library

UNIT II: JAVA PROGRAMMING

CONTENTS

Introduction: Java Applications, Memory Concepts, Arithmetic, Decision making, Equality and Relational Operators. Java Applets, Drawing strings and lines.
Control Statements: If, if … else, selection statements, while statement, compound assignment operators, increment decrement operators, for … statement, do …. While, switch, break and continue, labeled break and continue, logical operators.
Methods in Java: declarations, argument promotions, scope of declarations, method overloading, Recursion.
Arrays: declaring and creating references and reference parameters, passing arrays to methods, multi dimensional arrays.

Inheritance and polymorphism: super class and subclass, protected members, Relation ship between super and sub class. Inheritance hierarchy, abstract classes and methods, final methods and classes, nested classes, Type wrappers.
Exception handling: java exception hierarchy, rethrowing an exception, finally clause, stack unwinding, chained exception, declaring new exception types.
Multithreading: Life cycle of a thread, and scheduling, creating and executing threads synchronization.
Files and streams, hierarchy, files and streams, File class, Sequential access file manipulation, random access file handling, Introduction to String class and its members.

8. Learning and Teaching Strategy

- Students do hands-on-practice on computers.
- Students will do structured exercises and solve numerical problems.
- Students will make self-study from classroom notes, text books and from websites.
- Students will participate in short-term coursework.
- Seminar/workshop, quiz, debate competitions will be organized and students will be encouraged to participate subject to resource availability.
- Students will discuss the concepts in peer groups during informal conversation and share knowledge.

9. Assessment Strategy

- As a self assessment tool, exercises will be solved by students to check their understanding of particular concepts and terminology.
- As formative assessment tools, students may be asked to make oral presentations, write essay/short notes etc.
- Teacher may ask students to make their own research about particular topic using library resources or internet and then produce computerized report. These reports can be assessed formatively or can be awarded as summative assessment.
- There will be comprehensive final examination (Paper-Pencil test) to give score to each student and record them for administrative purpose.

10. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40**	**I,ii,iii,iv**

11 Strategy for feedback and student support during module

Students will be given feedback for formative assessments to tell them how they are progressing in terms of knowledge, skills and understanding of a subject. Feedback will be given to the students either during or after the assessment.
Teaching team will re-evaluate teaching methods for problematic area and work toward improving student learning. Some additional support like Off-class student counseling, remedial classes for week students may also be provided if required.

12 Indicative Resources

Core Text

- Britton, Carol., [2005]*,A student guide to object-oriented development,* Library Call No: 005.12 BRI 2005
- E. BalaguruSamy, [2004]*, Object Oriented Programming with C++,* Second Edition, Tata McGraw Hill, New Delhi, ISBN 0-07-040211-6
- James Rumbaugh, Michael Blaha and others, [2002]*, Object Oriented Modeling and Design,* PHI Pvt. Ltd, New Delhi, ISBN 81-203-1046-2
- Mark Allen Weiss., [2006]*, Data Structures and Algorithm Analysis in C++,* Third Edition, Pearson International Edition, ISBN 0-321-39733-9
- Walter Savitch, [2007]*, Problem Solving with C++,* Sixth Edition, Pearson International Edition, ISBN 0-321-44263-6

Background Texts

- Mark A. Weiss. , [2005], *Data Structures and Problem Solving Using C++,* Third Edition, Addison-Wesley, ISBN 0-321-40992-2
- Paul J. Deitel, Harvey M. Deitel, [2005], *Simply C++ - An Application-Driven Tutorial Approach,* Prentice Hall, ISBN 0-13-127768-5
- Sara Baase, Allen Van Gelder , [2000], *Computer Algorithms- Introduction to Design and Analysis,* Third Edition, Addison Wesley, ISBN 0-201-61244-5

Journals

Online Journals

http://www.springerlink.com/

http://ieeexplore.ieee.org/

Key websites and on-line resources

C++ online help

http://www.freetechbooks.com

http://www.laynetworks.com/cs04.htm

http://pages.cs.wisc.edu/~smoler/x86text/lect.notes/data.structures.html

Teaching/Technical Assistance

- One Tutorial Assistant
- One Lab Attendant

Laboratory space and equipment

- Students require weekly 5 hours Hands-on-practice in Computer Lab (80 computers minimum required for individual access)
- LCD Projector for routine lectures and seminars, whiteboard, marker pens.
- Weekly 5 Internet hours are required for staff as well as students to access online study material.

Computer requirements

Turbo C++ / Visual C++ compiler together with multiple licenses for educational purposes. Ms-Windows, Ms-Word and Ms-Power point are required for preparation of lecture notes, assignments and presentations.

13. Teaching Team

Lecturer NIYIKIZA Gaston

Lecturer KAGARAMA John Baptist

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
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Seen and agreed

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Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 10

1. Module Code: ___CSC 110 **SCHOOL:** SCIENCE AND TECHNOLOGY

2. Module Title: INTRODUCTION TO SCIENTIFIC RESEARCH

3. Level: 1 Semester: 2 Credits: 12___

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisites:

YEAR 1 SEMESTER 1 MODULES

6. Allocation of study and teaching hours

Total student hours: 120	**Student Hours**	**Teacher's load**
Lectures	**40**	**60**
Seminars/workshops	**10**	**10**
Practical classes/laboratory	**20**	**20**
Structured exercises	**10**	**10**
Set reading etc.	**10**	**-**
Self-directed study	**10**	**-**
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other (Invigilation, Marking)		
TOTAL	120	120

6.1 Brief description of aims and content

- To introduce students to the Nature and full concepts of scientific Research.
- To teach students the conception, elaboration, analysis and redaction of scientific research work.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students should be able to demonstrate knowledge and understanding of:

i) The Research Process
ii) Ethical Issues in research

iii) Problem Definition and Research Proposal

iv) Exploratory research and Qualitative Analysis

v) Secondary Data

vi) Research Methods

vii) Editing and Coding

viii) Data Analysis and Interpretation

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be applying the knowledge related to:

ix) The Research Process
x) Ethical Issues in research
xi) Problem Definition and Research Proposal
xii) Exploratory research and Qualitative Analysis
xiii) Secondary Data
xiv) Research Methods
xv) Editing and Coding
xvi) Data Analysis and Interpretation

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

- Set a research problem, gather data, analyse the data gathered and interpret the results form analyses.

iv) General transferable skills

Having successfully completed the module, students should be able to:

- Share the above gathered practical skills.

7. Indicative Content

- Introduction
- Studying method and technology used in scientific research
- Learning how to collect and analyse data.

8. Learning and Teaching Strategy

- Class participation
- Students cantered strategy.

9. ASSESSMENT STRATEGY

- Assignment
- Class group study (Project)
- Examination

10. ASSESSMENT PATTERN

Component	Weighting (%)	Learning objectives covered
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11. STRATEGY FOR FEEDBACK AND STUDENT SUPPORT DURING MODULE

- Social interactions between teacher of students
- Hoping to get responses from students

12. INDICATIVE RESOURCES
Core Text (include number in library or URL) (inc ISBN)

- SELLTIZ , WRIGHTSMAN and COOK., *Research Methods in Social Relations*, New York, Holt, 1996
- YA-LUN CHOU, *Statistical Analysis with Business and Economic Applications.* New York, Holt, 1995
- GRAWITZ, M., *Méthodes des sciences sociales*, Dalloz, Paris, 1952
- VIET, J., *Les méthodes structuralistes dans les sciences sociales*

13: TEACHING TEAM

Dr. NDAYAMBAJE Pius

DUSHIMIMANA Jean de Dieu

UWIMBABAZI Bernadette

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the program to confirm agreement.

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Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

Republic of Rwanda

HIGHER EDUCATION COUNCIL

Kigali Independent University ULK

COMPUTER SCIENCE

YEAR 2

MODULES DESCRIPTIONS FORMS

MODULES DESCRIPTIONS IN YEAR 2, COMPUTER SCIENCE

	Code	Courses in Computer Science Dept.	Credits	Hrs
1.	CSC201	**English Language Skills II**	**12**	**120**
2.	CSC202	**Linear Algebra**	**12**	**120**
		Unit 1: Matrices	6	60
		Unit 2: Determinants	6	60
3.	CSC203	**Microcomputer Systems**	**12**	**120**
		Unit 1: Digital Logic Design	6	60
		Unit 2: Microprocessor & Interfacing	6	60
4.	CSC204	**Database Management Systems**	**12**	**120**
		Unit 1: Introduction to Database Management Systems	6	60
		Unit 2: Database Design I	6	60
5.	CSC205	**Programming Languages & Paradigms**	**12**	**120**
		Unit 1: Java Programming	6	60
		Unit 2: Object-Oriented Programming with Java	6	60
6.	CSC206	**Differential Equations**	**12**	**120**
		Unit 1: Ordinary Differential Equations	6	60
		Unit 2: Partial Differential Equations	6	60
7.	CSC207	**Discrete Mathematics**	**12**	**120**
		Unit 1: Logic & Mathematical Reasoning	6	60
		Unit 2: Graphs Theory	6	60
8.	CSC208	**Data Structures & Algorithms**	**12**	**120**

		Unit 1: Algorithms Design & Analysis Unit 2: Data Structures & Programming	6 6	60 60
9	CSC209	**Data & Computer Communications** Unit 1: Data Communications Unit 2: Computer Communications	**12** 6 6	**120** 60 60
10	CSC210	**Internet & Web Technologies** Unit 1: Web Technologies Unit 2: Web Programming & Design	**12** 6 6	**120** 60 60
		TOTAL	**120**	**1200**

MODULE 1

1 Module Code: .....CSC201..... **School:** SCIENCE AND TECHNOLOGY

2. Module Title: English Language Skills II

3. Level: 2 Semester: 1 Credits: 12

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

YEAR 1 (LEVEL 1) COURSES

6. Allocation of study and teaching hours

Total student hours: 120	**Student Hours**	**Teacher's load**
Lectures	**40**	**60**
Seminars/workshops	**10**	**10**
Practical classes/laboratory	**20**	**20**
Structured exercises	**10**	**10**
Set reading etc.	**10**	**-**
Self-directed study	**10**	**-**
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other (Invigilation, Marking)		
TOTAL	120	120

6.1 Brief description of aims and content

The objective of this course is to allow students to develop factual descriptive writing and the drawing of conclusions from data and to further develop listening and speaking skills covering a wide range of topical subjects including education, science, business and the news.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students should be able to demonstrate knowledge and understanding of:

- Providing sufficient knowledge in the four language skills: Listening, Speaking,Reading,Writing, and demonstrating techniques in correspondence and communication
- Understanding that English is a vital working tools globally.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to demonstrate knowledge and understanding of:

- The fundamental knowledge in English letter writing and other scientific documentary writings, and the importance of English in general.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

- Apply the English language skills in the day-to-day life.

iv) General Transferable Skills

Having successfully completed the module, students should be able to:

- Share the above gathered practical skills.

7. Indicative Content

*** i:** indefinite adjectives

*** ii : conjuctions**

*** iii:** formal writing

*** iv:** composition writing

*** v:** active and passive modes

*** vi:** phrasal verbs

*** vii:** question tags

*** viii:** gerunds

*** ix:** language functions

*** x:** summarizing and paraphrasing

* **xi**: consolidation

8. Learning and Teaching Strategy

. Student centered:

-Face to face lectures

-giving students research topics

- Workshops

9. Assessment Strategy

-practical group class work

-Individual practical course work

-Various assignments and lastly the final examination on the general module

10 Assessment Pattern

Component	**Weighting (%)**	**Learning objectives covered**
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11 Strategy for feedback and student support during module

- Each Presentation is marked, marks post on the course Web on the University Online Campus Platform, with immediate feedback (direct contact with the student or contact through the online courses platform);

- ❖ Specimen examination papers and solutions available

12. Indicative Resources

Core Text (include number in library or URL) (inc ISBN)

Indicative Reading List

ULK Centre of Languages Year 2 Text Book.

13. Teaching Team

RUDASINGWA Claudien

UMUMARARUNGU Christine

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
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Seen and agreed

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Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 2

1 Module Code: .....CSC202..... **School:** SCIENCE AND TECHNOLOGY

2. Module Title: LINEAR ALGEBRA

3. Level: 2 Semester: 1 Credits: 12

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

CSC102-CALCULUS 1

CSC107-CALCULUS II

6. Allocation of study and teaching hours

Total student hours: 120	**Student Hours**	**Teacher's load**
Lectures	**40**	**60**
Seminars/workshops	**10**	**10**
Practical classes/laboratory	**20**	**20**
Structured exercises	**10**	**10**
Set reading etc.	**10**	**-**
Self-directed study	**10**	**-**
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other (Invigilation, Marking)		
TOTAL	120	120

6.1 Brief description of aims and content

This module provides a good understanding of linear algebra concepts / matrix computations by hand, practical algebraic concepts and methods that are useful in data analysis applications, links between vector space representations and matrices, and between decompositions such as

eigenvalue decomposition, singular value decomposition, linear systems, least squares solutions. To provide a working understanding of matrices and vector spaces for later modules to build on and to teach students practical techniques and algorithms for fundamental matrix operations and solving linear equations.
They must also understand the equivalence of linear maps between vector spaces and matrices and be able to row reduce a matrix, compute its rank and solve systems of linear equations. The definition of a determinant in all dimensions will be given in detail, together with applications and techniques for calculating determinants. Students must know the definition of the eigenvalues and eigenvectors of a linear map or matrix, and know how to calculate them.

6.2 Learning Outcomes

i) Knowledge and Understanding

Upon completion of this module the students will be able to:

- Solve a range of predictable or less predictable problems in Linear Algebra.
- Have an awareness of the basic concepts of theoretical mathematics in Linear Algebra.
- Have a broad knowledge and basic understanding of these subjects demonstrated through one of the following topic areas: Vectors in Rn, matrices and determinants, Vector spaces over R and linear mappings., Complex numbers and Cn as a vector space, Diagonalisation and Jordan normal form, Inner product spaces, Introduction to groups and Special polynomials.
- Understand matrices.
- Understand Determinant.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

- Develop the intuitive understanding, theory, and computational skills necessary for the concepts of calculus of functions of several variables by tying together vector differential calculus with vector integral calculus.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

- Construct and present mathematical arguments with accuracy and clarity.

iv) General transferable skills

Having successfully completed the module, students will be able to:

- Appreciation the concepts of data analysis, and knowledge of how to select and interpret an appropriate method of Linear Algebra.

- Understand of the use of mathematics, and an assimilation of mathematical theory studied outside this module into a linear framework.

7. Indicative Content

UNIT I: VECTOR CALCULUS

Vectors: Properties of vectors, addition, subtraction, scalar multiplication, vector in R^n; dot and cross products of vectors, Vectors spaces: definition, basis, and dimension, subspaces.

Applications of Vector: Analytic Geometry: Equations of lines, planes and volumes, Physics: Work done, Moments, Normal flux and Angular velocity of a rigid body.

Vector Analysis: Derivatives of Vectors, (Grad, Div, line and surface integrals), Stoke's theorem, Green's theorem, divergence theorem, Parametric surfaces, Potential Theory. Physical applications.

UNIT II: LINEAR ALGEBRA

Matrices: Definition, Equality, Operations, Types of Matrices, Inverse of a Square matrix; minors and cofactors; Transpose, Echelon matrix, Rank of matrix, evaluation of

Linear transformations: Linear mappings, the kernel image of a linear map, dimension of kernel, the matrix associated with a linear map; Systems of linear equations (consistent and inconsistent equations); the Gaussian elimination method, Cholesky-Jordan algorithm, Gram-Schmidt method.

Determinants: Operations Eigenvalues and Eigenvectors, diagonalisation, Cayley-Hamilton Theorem, Jordan form.

8. Learning and Teaching Strategy

- Teacher may ask students to prepare presentations to encourage students to make they own research.
- Teacher may ask students to make their own research about particular topic using library resources or internet and then produce report. These reports can be assessed formatively to give feedback to students
- Alternatively some of the assessment tools mentioned above can be used by teacher to award marks and record them for administrative purposes as summative assessment.
- There will be comprehensive final examination (Paper-Pencil test) to give score to each student and record them for administrative purpose.

9. Assessment Strategy

Assignments (Class works and Homeworks)
Examination

10. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11 Strategy for feedback and student support during module

Correction in class of written in-course tests, assignment, exercises and discussion in group work for case studies given before to students allow them to mustering the course very well.

12 Indicative Resources

Core Text (include number in library or URL) (inc ISBN)

David Towers, Guide to Linear Algebra*, Macmillan 1988.*

Howard Anton, Elementary Linear Algebra*, 7th Edition, John Wiley and Sons, 1994.*

Paul Halmos, Linear Algebra Problem Book*, MAA, 1995.*

G Strang, Linear Algebra and its Applications*, 3rd ed, Harcourt Brace, 1988.*

13. Teaching Team

Dr KARAMBIZI Sylvestre

TWAGILIMANA Cyprien

UWITONZE Alfred

NAHIMANA Godefroid

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

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Seen and agreed

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ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 3

1 Module Code: .....CSC203..... **School:** SCIENCE AND TECHNOLOGY

2. Module Title: MICROCOMPUTER SYSTEMS

3. Level: 2 Semester: 1 Credits: 12

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

6. Allocation of study and teaching hours

Total student hours: 120	**Student Hours**	**Teacher's load**
Lectures	**40**	**60**
Seminars/workshops	**10**	**10**
Practical classes/laboratory	**20**	**20**
Structured exercises	**10**	**10**
Set reading etc.	**10**	**-**
Self-directed study	**10**	**-**
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other (Invigilation, Marking)		
TOTAL	120	120

6.1 Brief description of aims and content

This module introduces the main characteristics of microprocessors and of the units based on microprocessors. It also depicts the design of highly universal structures based on the 16 and 32 bits microprocessors and the programming of the appropriate system interfaces. Intel 8085 will be described in detail as it gives the basic knowledge of microprocessor and it is widely used for students' training. It is an 8-bit microprocessor. 8-bit microprocessor-based system or

8-bit microcontrollers are widely used for industrial control, instrumentation and consumer appliances.16-, 32-, and 64-Bit microprocessors which are more powerful and are widely used for powerful microcomputers, servers, supercomputers and sophisticated automatic control will be described in this module.

6.2 Learning Outcomes

i) Knowledge and Understanding

On completion of the module, students should have knowledge and understanding of:

a) Evolution and classification of microprocessors
b) Structure and architecture of microprocessors
c) Instruction cycle and machine cycle
c) Addressing modes of microprocessors
d) Operation of interrupt system
e) Interfacing of microprocessors
f) Programming of microprocessors

ii) Cognitive/Intellectual skills/Application of Knowledge

On successful completion of the Module, students will have the knowledge of:

a) Evolution and classification of microprocessors
b) structure and architecture of high performance microprocessors
c) Interfacing microprocessors

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

On completion of this module, students will be able to:

a) Write assembly language programs for intel 8085 and intel 8086
b) Use intel 8085 and intel 8086 microprocessor kits

iv) General transferable skills

Having successfully completed the module, students should be able to:

- ✓ Explain, diffuse and disseminate knowledge on practical skills related to microprocessors
- ✓ Explain, diffuse and disseminate knowledge on practical skills related to assembly language

7. Indicative Content

1. The evolution and classification of microprocessors.

2. Structure and architecture of 16 bits, 32 and 64 bits microprocessors.

3. Structure design based on 16 and 32 bits microprocessors.

4. Functional units: Internal resources, Instruction cycle, machine cycle.

5. The operation of the interruption system, Synchronization with an external logic, the design of a 16 bit microprocessor based structure, EPROM and RAM system memory.

6. I/O interfaces coupling as a local resource. Interrupt system.

7. The design of the control logic for non-maskable interrupts.

8. Real-time clock, serial interface, parallel interface and DMA module.

9. The design of a 32 bits microprocessor based structure.

10. The characteristics of 32 and 64 bits microprocessor based systems.

8. Learning and Teaching Strategy

Basic knowledge and understanding of assembly language programs for intel 8085 are developed, which contain discussion elements based on problem examples that are intended to stimulate students to research topics of interest. Skill development takes place using self-directed laboratory practicals based on problem themes and examples where the knowledge and understanding may be applied.

The laboratory practicals contain some worked examples and more presented as non-assessed exercises which are then discussed in class. The exercises are intended to reinforce the practical material. Practical notes are provided on the website and hard copies and so are problem sheets for practical exercises.

9. Assessment Strategy

(i) Learning Outcomes are evaluated using a 3 hours end-of-semester examination.

(ii) Self-directed learning is evaluated by giving the students practical laboratories that they will discuss in groups; solve and present during laboratory practicals

(iii) The use of appropriate referencing is evaluated in written assignments (TP)

(iv) The ability to communicate effectively using assembly language programs is evaluated by a group assignment where groups present prescribed topic to their peers in a practical context. The presentations and accompanying reports are evaluated by the lecturer and peer assessment in used.

10. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11 Strategy for feedback and student support during module

(i) Examples and exercises/specimen practicals in each weekly set of self-study notes, with solutions provide self-assessment

(ii) Each practical assignment is marked with immediate feedback

(i) Specimen examination papers and solutions available

12 Indicative Resources

Core Text:

1. B. Ram: Fundamentals of Microprocessors and Microcomputers, 5th edition, Dhanpat Rai Publications (P), 2001

2. William Stallings: Computer Organization & Architecture: Design for Performance, 7th edition, Prentice Hall, 2006

13. Teaching Team

UWITONZE Alfred

NDASHIMYE Emmanuel

NAHIMANA Godefroid

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, Science and Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 4

1 Module Code: .....CSC204..... **School:** SCIENCE AND TECHNOLOGY

2. Module Title: DATABASE MANAGEMENT SYSTEMS

3. Level: 2 Semester: 1 Credits: 12

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

CSC104: INFORMATION TECHNOLOGY

6. Allocation of study and teaching hours

Total student hours: 120	**Student Hours**	**Teacher's load**
Lectures	**40**	**60**
Seminars/workshops	**10**	**10**
Practical classes/laboratory	**20**	**20**
Structured exercises	**10**	**10**
Set reading etc.	**10**	**-**
Self-directed study	**10**	**-**
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other (Invigilation, Marking)		
TOTAL	120	120

6.1 Brief description of aims and content

Manual Information processing has certain limitations whereas computerized databases and software can increase productivity. This module addresses advanced issues in relational database design and software engineering. It is aimed to help students to analyse the real life problems and explore the possibilities how a computerised system can help in solving the problems.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students will be able to demonstrate knowledge and understanding of:

i. Relational Database Management System and its related terminology

ii. Raising the general level of competence in Database Management System

iii. Relational database concepts

iv. Data modelling concepts

v. Best practice and quality issues of Database systems are understood and implemented.

vi. Designing Databases with the help of Ms SQL Server tool.

vii. The role of Data Bases in Business

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students will be able to:

viii. Analyze database and software requirement of any organization.
ix. Criticize a given set of documentation for a software product.
x. Explain RDBMS and Software Engineering concepts to future learners in effective manner

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students will be able to:

xi. Given a set of informal specifications, produce a set of formal specifications for the same problem.
xii. Develop and manipulate databases in any available RDBMS technology ensuring fast data retrieval, data protection and security.

iv) General transferable skills

Having successfully completed the module, students should be able to:

xiii. Demonstrate managerial skills.
xiv. Develop social and personal etiquettes to face organizational challenges and stand in leading position confidently.

7. Indicative Content

Unit I: Introduction to Database Management System

Introduction to DBMS. Data Models and Representation of data. Database Functions. Database Design Concept. RDBMS, Relational Algebra and Relational Calculus. Introduction to emerging database technologies. File-Based Systems. Level of Abstraction. Database Languages.The Data Definition Language (DDL), The Data Manipulation Language (DML). Views in Database Management System. Relational Algebra and Calculus, Relational model, The relational algebra, Functional dependencies and Normalization

Unit II: Database Design with Ms SQL Server

Introduction to Ms SQL Server. Getting Microsoft SQL Server, Connection to a Microsoft SQL Server Database System, Introduction to SQL Code Writing,The SQL Interpreter,SQL Code and SQL Query Analyzer, Fundamentals of Creating a Database,SQL Server Enterprise, ManagerPractical Learning: Creating a Database in the Enterprise Manager, SQL – Structured Query Language,SQL Data Types, SQL Syntax,SQL JOIN.

8. Learning and Teaching Strategy

Lectures will introduce the concepts of database. They will also describe some of the practical aspect of database design. The Laboratories assessments will be supervised by a Lecturer. Students will try to work sometimes independently and in group to let them digest the problem and to owner the understanding.

9. Assessment Strategy

Formative and summative assessments are organized.

In-course assessment composed of written test, assignment or homework and handled practical assignment must be organized. Students have to receive comments on their works and results where it is needed.

In-course assessment counts for 40% of the whole course marks while the final examination of 2 h 30’ duration will count for 60% and cover the whole content.

10. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11 Strategy for feedback and student support during module

During the lectures, there may be quizzes and discussions in groups with a plenary feedback. Participation will be encouraged. The corrections of laboratories exercises will be done in labs or in classes.

12 Indicative Resources

Core Text books

- Gerald V., [1999], *Database Management Systems designing and building, Business applications* by Post, Library Call No: 005.74 POS 1999
- Date C.J., [2004], *An Introduction to Database Systems,* Eighth Edition, Addison Wesley, ISBN 0-321-18956-6
- Christian Drawson, [2005], *Projects in Computing and Information Systems-A Student's Guide,* Addison Wesley, ISBN 0-321-26355-3
- Fred McFadden, Jeffery A. Hoffer, Mary Prescott, [2007], *Modern Database Management,* Eighth Edition, Prentice Hall, ISBN 0-13-221211-0

Journals

- http://www.springerlink.com/ online journal
- http://ieeexplore.ieee.org/ online journal

- 'A Veritable Bucket of Facts:' Origins of the Data Base Management System," ACM SIGMOD Record 35:2 (June 2006).
- Association for Computing Machinery SIGIR Forum archive Volume 7, Issue 4
- Codd, E.F. (1970). "A Relational Model of Data for Large Shared Data Banks". Communications of the ACM 13 (6): 377–387.
- The origins of the data base concept, early DBMS systems including IDS and IMS, the Data Base Task Group, and the hierarchical, network and relational data models, discussed in Thomas Haigh

Key websites and on-line resources

Ms-Access Software online helps

Ms-SQL Server 2000 online helps

http://www.softlookup.com/tutorial/

http://www.freetechbooks.com/

http://www.ittestpapers.com/interviewquestions/dbms1.html

http://en.wikipedia.org/wiki/Database_management_system

http://mis.bus.sfu.ca/tutorials/MSAccess/tutorials/intro.pdf

http://www.utexas.edu/its/windows/database/datamodeling/index.html

http://infolab.stanford.edu/~ullman/fcdb/oracle.html

13. Teaching Team

Mr. KAGARAMA J. Baptist (Team leader)

Mr. NIYIKIZA Gaston (member)

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
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4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

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Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 5

1 Module Code: ..... CSC205 ..... **School:** SCIENCE AND TECHNOLOGY

2. Module Title: PROGRAMMING LANGUAGES AND PARADIGMS

3. Level: 2 Semester: 1 Credits: 12

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

CSC105-INTRODUCTION TO COMPUTER SCIENCE

6. Allocation of study and teaching hours

Total student hours: 120	**Student Hours**	**Teacher's load**
Lectures	**40**	**60**
Seminars/workshops	**10**	**10**
Practical classes/laboratory	**20**	**20**
Structured exercises	**10**	**10**
Set reading etc.	**10**	**-**
Self-directed study	**10**	**-**
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other (Invigilation, Marking)		
TOTAL	120	120

6.1 Brief description of aims and content

The module comprises two units, namely Java programming and Object-Oriented Programming with Java. The first unit is designed to give students a good understanding of basic concepts in Java necessary to develop small applications (programming in the small). Apart from the concept of the Java Virtual Machine, students are acquainted to the grammar of Java, operators, data types, expressions, blocks, statements and control structures, standard mathematical functions and Strings, arrays, I/O streams and file input/output as well as output

formatting. The second unit aims at developing students ability to write large applications (programming in the large) using object-oriented programming to solve real application problems. Classes and objects, inheritance, graphical user interface, graphics and event-driven programming as well as connectivity with databases are presented and practiced in order to get knowledge and skills necessary to develop large software.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module; students should be able to demonstrate knowledge and understanding of:

i. Basics of programming in Java Language
ii. Object Oriented concepts and their implementation in Java
iii. Event Driven Programming, Java Database Connectivity, and multithreading

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

iv. Apply their knowledge of Object Oriented Concepts in design of Real World Application software etc.
v. Enhance performance of a normal software code by applying reusability, modularity concepts of OOP.
vi. Explain OOP concepts to team mates and colleagues at workplace.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

vii. Present their ideas to a general audience using reasonable written and oral communication skills.
viii. Use the Java programming power to solve different problems.

iv) General transferable skills

Having successfully completed the module, students should be able to:

ix. Justify the importance of team sprit to solve a common problem.
x. Be self contained to perform assigned tasks independently or with little guidance.
xi. Complete their assigned task under tough time constraints.

7. Indicative Content

UNIT I: JAVA PROGRAMMING

CONTENTS

Introduction: Java Applications, Memory Concepts, Arithmetic, Decision making, Equality and Relational Operators. Java Applets, Drawing strings and lines.

Control Statements: If, if … else, selection statements, while statement, compound assignment operators, increment decrement operators, for … statement, do …. While, switch, break and continue, labeled break and continue, logical operators.

Methods in Java: declarations, argument promotions, scope of declarations, method overloading, Recursion.

Arrays: declaring and creating references and reference parameters, passing arrays to methods, multi dimensional arrays.

Inheritance and polymorphism: super class and subclass, protected members, Relation ship between super and sub class. Inheritance hierarchy, abstract classes and methods, final methods and classes, nested classes, Type wrappers.

Exception handling: java exception hierarchy, rethrowing an exception, finally clause, stack unwinding, chained exception, declaring new exception types.

Multithreading: Life cycle of a thread, and scheduling, creating and executing threads synchronization.

Files and streams, hierarchy, files and streams, File class, Sequential access file manipulation, random access file handling, Introduction to String class and its members.

UNIT II: OOP with JAVA

Java graphics: Drawing Lines and shapes; java 2D graphics; adding sounds, images and simple animation. Java programming using swing components, layout managers; using the event-driven model; Java Database Connectivity.

8. Learning and Teaching Strategy

- Students do hands-on-practice on computers.
- Students will do structured exercises and solve practical problems.
- Students will make self-study from classroom notes, text books and from websites.
- Students will participate in short-term coursework.
- Students will discuss the concepts in peer groups during informal conversation and share knowledge.

9. Assessment Strategy

- As a self assessment tool, exercises will be solved by students to check their understanding of particular concepts and terminology.
- As formative assessment tools, students may be asked to make oral presentations, write essay/short notes etc.
- Teacher may ask students to make their own research about particular topic using library resources or internet and then produce computerized report. These reports can be assessed formatively or can be awarded as summative assessment.
- There will be comprehensive final examination (Paper-Pencil test) to give score to each student and record them for administrative purpose.

10. Assessment Pattern

Component	**Weighting (%)**	**Learning objectives covered**
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11 Strategy for feedback and student support during module

Students will be given feedback for formative assessments to tell them how they are progressing in terms of knowledge, skills and understanding of a subject. Feedback will be given to the students either during or after the assessment.

Teaching team will re-evaluate teaching methods for problematic area and work toward improving student learning.

12 Indicative Resources

Core Text

- Britton, Carol., [2005]*,A student guide to object-oriented development,* Library Call No: 005.12 BRI 2005
- James Rumbaugh, Michael Blaha and others, [2002]*, Object Oriented Modeling and Design,* PHI Pvt. Ltd, New Delhi, ISBN 81-203-1046-2
- John Lewis,William Loftus,[2009], Java Software Solutions, Addison Wesley,ISBN 0-321-54934-1
- Tony Gaddis,[2008], Starting out with Java, Addison Wesley, ISBN 0-321-47927-0
- Y Daniel Liang, [2009], Introduction to Java Programming, Prentice Hall, ISBN 0-13-605966-X

13. Teaching Team

DR. NDAYAMBAJE PIUS

MR. KAGARAMA JOHN BAPTIST

MR. NIYIKIZA GASTON

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature NDAYAMBAJE Pius, Dean, Science and Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
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4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

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ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 6

1. Module Code: CSC 206**.....School:** SCIENCE AND TECHNOLOGY

2. Module Title: DIFFERENTIAL EQUATIONS

3. Level: 2 Semester: 2 Credits: 12

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

*** CSC102-CALCULUS I**

*** CSC 107-CALCULUS II**

6. Allocation of study and teaching hours

Total student hours: 120	**Student Hours**	**Teacher's load**
Lectures	**40**	**60**
Seminars/workshops	**10**	**10**
Practical classes/laboratory	**20**	**20**
Structured exercises	**10**	**10**
Set reading etc.	**10**	**-**
Self-directed study	**10**	**-**
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other (Invigilation, Marking)		
TOTAL	120	120

6.1 Brief description of aims and content

Differential equations are at the heart of nearly all modern applications of mathematics to natural phenomena. Computerized applications play a vital role in many areas of modern technology.
The aims of this module are:

- To develop a basic understanding of the theory and methods of solution for Partial Differential Equations.
- To develop a basic understanding of the ideas of approximate (numerical) solution to certain Partial Differential Equations.

6.2 Learning Outcomes

i) Knowledge and Understanding

On completion of this module the students will be able:

i. To solve ordinary and partial differential equations as well as their applications in solving scientific problems.
ii. To solve elementary first and second order differential equations; model simple applications.
iii. To solve problems in Partial Differential Equations;
iv. To have an understanding of theoretical mathematics in the field of Partial Differential Equations;

ii) Cognitive/Intellectual skills/Application of Knowledge

On completion of this module the students should be able to:

v. Solve ordinary and partial differential equations as well as their applications in solving scientific problems.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

vi. Construct and present mathematical arguments with accuracy and clarity.

iv) General transferable skills

Having successfully completed the module, students should be able to:

vii. Appreciate the concepts of data analysis, and knowledge of how to select and interpret an appropriate method of differential equations.

viii. Understand the use of mathematics, and an assimilation of mathematical theory studied outside this module into a linear framework.

7. Indicative Content

UNIT I: ORDINARY DIFFERENTIAL EQUATIONS

Differential equations of 1^{st} order and 1^{st} degree; Resolution of differential equations of 1^{st} order and 1^{st} degree; homogeneous, linear ,exact equations. Equations of orders greater than one; complementary integral (CI) and particular integral (PI); the D-operator ordinary. Rules for finding complementary functions (CF). Application of linear differential equations in Electro-mechanical systems (RI, RC, LC, RLC, springs) and beams. Series solutions of Differential Equations. Legendre's Equation and Legendre Polynomials $P_n(x)$ as its solutions; orthogonality of Legendre's polynomials. Relations between Legendre's Polynomials and their derivatives). Bessel's functions and Bessel's equations and its solutions, integral representation of Bessel functions; Gamma and Beta functions: definitions, properties, and relations between Gamma and Beta functions. Bessel's functions of 2^{nd} kind. Applications.

UNIT II: PARTIAL DIFFERENTIAL EQUATIONS

Partial Differentiation: Definition and theorems, higher order partial derivatives; total differentiation-the chain rule and change of variables, the Jacobian matrix; Taylor's theorem of two or more variables; extrema-constrained; extrema and Lagrange's multipliers.

Partial Differential Equations: Basic concepts. Separation of variables. Laplace's Equation in Cylindrical and Spherical Coordinates, Potential. Linear partial differential equations of order one, nonlinear differential equations of order one, Complete solution.

8. Learning and Teaching Strategy

The role of the lecturer is to be a facilitator. He must be always at the level of knowing what the student has understood about the subject taught. He must give clarifications so that students are able to go for research of more details. Lecturer has to give more assignment, group work and homework to students. He must try always to give case studies to students to let them digest well the subject and to know how to apply it to real life. Because of the system of students centred learning more Seminars and practical are given to students.

9. Assessment Strategy

-practical group class work

-Individual practical course work

-Various assignments and lastly the final examination on the general module

10. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11. Strategy for feedback and student support during module

Correction in class or in computer laboratory of written in-course tests, assignment, exercises and discussion in group work for case studies given before to students allow them to mustering the course very well.

12 Indicative Resources

Core Text (include number in library or URL) (Inc ISBN)

Indicative Reading List

- ✓ Zafar Ahsan, Differential Equations and their applications, Prentice-Hall of India, New Delhi, 2001.
- ✓ Mary Attenborough, Mathematics for Electrical Engineering and Computing, Oxford, 2003.
- ✓ P. Blanchard, R. L. Devaney, G. R. Hall, *Differential Equations*, Thompson, 2006

13. Teaching Team

Dr KARAMBIZI Sylvestre

TWAGILIMANA Cyprien

NAHIMANA Godefroid

15. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

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ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 7

1. Module Code: CSC 207**.....School:** SCIENCE AND TECHNOLOGY

2. Module Title: DISCRETE MATHEMATICS.....

3. Level: 2 Semester: 2 Credits: 12

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

*** CSC102-CALCULUS I**

*** CSC107-CALCULUS II**

*** CSC202-LINEAR ALGEBRA**

*** CSC206-DIFFERENTIAL EQUATIONS**

6. Allocation of study and teaching hours

Total student hours: 120	**Student Hours**	**Teacher's load**
Lectures	**40**	**60**
Seminars/workshops	**10**	**10**
Practical classes/laboratory	**20**	**20**
Structured exercises	**10**	**10**
Set reading etc.	**10**	**-**
Self-directed study	**10**	**-**
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other (Invigilation, Marking)		
TOTAL	120	120

6.1 Brief description of aims and content

This module covers mathematics appropriate to Computing students. Its topics include linear algebra, linear programming, graph theory and abstract algebra.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students should be able to demonstrate knowledge and understanding of:

1. Identify connected graphs;
2. Identify Euler circuits and Hamiltonian cycles in a graph or else explain their non-existence;
3. Apply algorithms to determine minimal spanning trees and shortest paths; solve various types of counting problems;
4. Translate 'real world' problems into the language of graph theory and into counting problems and apply or find algorithms to solve them;
5. Solve simple problems involving integers modulo n;
6. Recognise the different types of ciphers and apply deciphering techniques; use principles of codes and apply some basic constructions.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

7. Reason logically and work analytically;
8. Perform with high levels of accuracy;
9. Manipulate discrete mathematical structures;
10. Apply basic mathematical concepts to problems of a routine and extended nature.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students will be able to:

11. Construct and present mathematical arguments with accuracy and clarity.

iv) General transferable skills

Having successfully completed the module, students will be able to:

12. Demonstrate skill in problem solving;
13. Adopt effective strategies for study;
14. Express ideas and methods of solution in the analysis of mathematical problems appropriately and effectively.

7. Indicative Content

A. Matrix Algebra

Matrices and matrix operations, Gaussian elimination, algebra of matrices, matrix inversion. Applications: solving systems of linear equations, networks, geometry of linear transformations, computer graphics.

B. Introduction to Linear Programming

Assumptions underlying the Linear Programming model, formulating Linear Programming problems, graphical representation and solution by graphical means, the Simplex Method.

C. Introduction to graph theory

Introduction to graph theory; Finite graphs; complete graphs; graph isomorphism; bipartite graphs; planarity. Euler's Theorem. The Handshaking Theorem. Subdivisions; Kuratowski's Theorem. Thickness. Adjacency matrix and use in evaluating paths. Trees, tree traversal algorithms.

D. Introduction to algebraic structures

Binary operations, groups, abelian groups, subgroups, congruence, modular arithmetic, rings, integral domains, fields.

E. Maple Lab

Use of Maple to solve systems of linear equations; Maple tutors to illustrate solution methods; the Simplex, Graph Theory and Group Theory packages.

8. Learning and Teaching Strategy

The role of the lecturer is to be a facilitator. He must be always at the level of knowing what the student has understood about the subject taught. He must give clarifications so that students are able to go for research of more details. Lecturer has to give more assignment, group work and homework to students. He must try always to give case studies to students to let them digest well the subject and to know how to apply it to real life. Because of the system of students centred learning more Seminars and practical are given to students.

9. Assessment Strategy

- Lecturer may ask students to prepare presentations to encourage students to make they own research.
- Lecturer may ask students to make their own research about particular topic using library resources or internet and then produce report. These reports can be assessed formatively to give feedback to students
- Alternatively some of the assessment tools mentioned above can be used by Lecturer to award marks and record them for administrative purposes as summative assessment.
- There will be comprehensive final examination (Paper-Pencil test) to give score to each student and record them for administrative purpose.

10. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11 Strategy for feedback and student support during module

Correction in class or in computer laboratory of written in-course tests, assignment, exercises and laboratory exercises, discussion in group work for case studies given before to students allow them to mustering the course very well.

12 Indicative Resources

Core texts

Recommended Book Resources

- John Taylor, Rowan Garnier, 2009, *Discrete Mathematics*, 3rd Ed., CRC Press [ISBN: 978-1439812808]

Supplementary Book Resources

- Kenneth H. Rosen 2003, *Discrete mathematics and its applications*, McGraw-Hill Boston [ISBN: 0072424346]
- Andrew Simpson 2002, *Discrete mathematics by example*, McGraw-Hill London [ISBN: 0077098404]

Other Resources

- Module-specific Website: *Blackboard*

  cit.blackboard.com

- Website: *Wolfram Alpha*

  www.wolframalpha.com

- Website: *MIT Mathematics*

  ocw.mit.edu/courses/mathematics/

13. Teaching Team

- **Dr KARAMBIZI Sylvestre (Module Leader)**
- **TWAGILIMANA Cyprien (Member)**
- **NDASHIMYE Emmanuel (Member)**
- **NAHIMANA Godefroid (Member)**

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

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4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

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ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 8

1. Module Code: CSC 208**.....** **SCHOOL**: SCIENCE AND TECHNOLOGY

2. Module Title: DATA STRUCTURES & ALGORITHMS....

3. Level: 2 Semester: 2 **Credits: 12**

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

*** 207-DISCRETE MATHEMATICS**

6. Allocation of study and teaching hours

Total student hours: 120	**Student Hours**	**Teacher's load**
Lectures	**40**	**60**
Seminars/workshops	**10**	**10**
Practical classes/laboratory	**20**	**20**
Structured exercises	**10**	**10**
Set reading etc.	**10**	**-**
Self-directed study	**10**	**-**
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other (Invigilation, Marking)		
TOTAL	120	120

6.1 Brief description of aims and content

Module consists of two courses "Analysis of algorithms" and "Data Structures and Programming"

#1. Introduces fundamental concepts of data structures and the algorithms that proceed from them.

#2. Introduces formal techniques to support the design and analysis of algorithms, focusing on both the underlying mathematical theory and practical considerations of efficiency.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students should be able to:

1. Explain the mathematical concepts used in describing the complexity of an algorithm.
2. Select and apply algorithms appropriate to a particular situation.
3. Employ one from a range of strategies leading to the design of algorithms to serve particular purposes.
4. Explain the trade-offs that exist between a range of algorithms that possess the same functionality.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

5. Demonstrate the fundamental knowledge of algorithmic techniques and concrete problems arising in elementary number theory and graph theory as well as data structures used in program construction.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

6. Understand the Basic Terminology: Elementary Data Organization, Data Structure Operations, Algorithms Complexity, Time-Space Trade off.
7. Demonstrate the knowledge of Physical storage media, File Organization, Organization records into blocks, Sequential blocks, Indexing & Hashing, Primary Indices, Secondary Indices, B+ tree Index files, B tree index files, Static Hash functions, Indexing & hashing comparisons.

iv) General Transferable Skills

Having successfully completed the module, students should be able to:

8. Demonstrate managerial skills
9. Justify the importance of team sprit to solve a common problem.
10. Be self contained to perform assigned tasks independently or with little guidance.
11. Complete their assigned task under tough time constraints.

7. Indicative Content

#1. "Data Structures and Programming"

Topics include recursion, the underlying philosophy of object-oriented programming, fundamental data structures (including stacks, queues, linked lists, hash tables, trees, and graphs), the basics of algorithmic analysis, and an introduction to the principles of language translation.

• Review of elementary programming concepts
• Fundamental data structures: Stacks; queues; linked lists; hash tables; trees; graphs

• Object-oriented programming: Object-oriented design; encapsulation and information hiding; classes; separation of behavior and implementation; class hierarchies; inheritance; polymorphism
• Fundamental computing algorithms: O(N log N) sorting algorithms; hash tables, including collision-avoidance strategies; binary search trees; representations of graphs; depth- and breadth-first traversals
• Recursion: The concept of recursion; recursive mathematical functions; simple recursive procedures; divide-and-conquer strategies; recursive backtracking; implementation of recursion
• Overview of programming languages: Programming paradigms
• Software engineering: Software validation; testing fundamentals, including test plan creation and test case generation; object-oriented testing

#2. "Analysis of Algorithm"

Topics include asymptotic complexity bounds, techniques of analysis, algorithmic strategies, and an introduction to automata theory and its application to language translation.
• Review of proof techniques
• Basic algorithmic analysis: Asymptotic analysis of upper and average complexity bounds; best, average, and worst case behaviors; big-O, little-o, □, and Ã˜ notation; standard complexity classes; empirical measurements of performance; time and space tradeoffs in algorithms; using recurrence relations to analyze recursive algorithms
• Fundamental algorithmic strategies: Brute-force; greedy; divide-and-conquer; backtracking; branch-and-bound; heuristics; pattern matching and string/text algorithms; numerical approximation
• Fundamental data structures: Implementation strategies for graphs and trees; performance issues for data structures
• Graph and tree algorithms: Depth- and breadth-first traversals; shortest-path algorithms (Dijkstra's and Floyd's algorithms); transitive closure (Floyd's algorithm); minimum spanning tree (Prim's and Kruskal's algorithms); topological sort
• Automata theory: Finite-state machines; Turing machines; context-free grammars; uncomputable functions; the halting problem; implications of uncomputability
• Introduction to language translation: Comparison of interpreters and compilers; language translation phases; machine-dependent and machine-independent aspects of translation; language translation as a software engineering activity

8. Learning and Teaching Strategy

Theory: Formal lectures will be presented to cover the material of the course, with tutorials.

Practical: Practical exercises, examples and seminar practices will be given to workout individually/groups.

Self-study: Students are also expected to undertake at least 100 hours private study including preparation of worked solutions for tutorial classes.

9. Assessment Strategy

Formative assessment is by means of regular tutorial exercises. Feedback to students on their solutions and their progress towards learning outcomes is provided during lectures and tutorial classes. The major component of summative assessment is the written examination at the end of the module. This gives students the opportunity to demonstrate their overall achievement of

learning outcomes. It also allows them to give evidence of the higher levels of knowledge and understanding required for above average marks.

10 Assessment Pattern

Component	**Weighting (%)**	**Learning objectives covered**
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11 Strategy for feedback and student support during module

- Consultation hours to see the students in the office.
- Two meeting with the students during the semester to discuss their problems (if any).
- Analyzing the results of the tests and seminars to reach possible problems and take measures to solve them.

12 Indicative Resources

Core Text (include number in library or URL) (Inc ISBN)

1. Jeffrey Childs C++: Classes and Data Structures / Prentice Hall, 2008, 416 pp, ISBN-10: 0131580515, ISBN-13: 9780131580510

2. Larry R. Nyhoff ADTs, Data Structures, and Problem Solving with C++, 2/E, Prentice Hall, 2005, 072 pp, ISBN-10: 0131409093, ISBN-13: 9780131409095

3. Richard Johnsonbaugh, Marcus Schaefer Algorithms, Prentice Hall, 2004, 768 pp, ISBN-10: 0023606924, ISBN-13: 9780023606922

13. Teaching Team

Lecturer NIYIKIZA Gaston

Lecturer KAGARAMA John Baptist

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 9

1. Module Code: CSC 209**.....** **SCHOOL**: SCIENCE AND TECHNOLOGY

2. Module Title: DATA & COMPUTER COMMUNICATIONS....

3. Level: 2 Semester: 2 Credits: 12

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

6. Allocation of study and teaching hours

Total student hours: 120	**Student Hours**	**Teacher's load**
Lectures	**40**	**60**
Seminars/workshops	**10**	**10**
Practical classes/laboratory	**20**	**20**
Structured exercises	**10**	**10**
Set reading etc.	**10**	**-**
Self-directed study	**10**	**-**
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other (Invigilation, Marking)		
TOTAL	120	120

6.1 Brief description of aims and content

This module introduces student in communications network architecture, communication network protocols, implementation and the work of local and wide area networks, client-server computing, data security and integrity on network, data communication through network, and network management. It develops the knowledge and the competency to student in networking implementation, security and control.

The aim of data and computer communications is to give students theoretical knowledge and practical experience in communications network architecture, communication network protocols, implementation and the work of local and wide area networks, client-server computing, data

security and integrity on network, data communication through network and network management.
The student should have the general understanding on different features of computer communications, data communications, advantages, and implementation, understand fundamental concepts of networks and their topologies, understand the concepts of data communications, network architecture and its hardware components.

6.2 Learning Outcomes

i) Knowledge and Understanding

On the completion of this module, students are expected to be able to:

i. Identify some contributors to networks and relate their achievements to the knowledge area
ii. Identify some components of a network
iii. Name some network devices and describe their purpose
iv. Define the meaning of a protocol
v. Understand fundamental concepts of networks and their topologies
vi. Explain the importance of security when dealing with networks
vii. Understand the concepts of network architecture and its hardware components
viii. Demonstrate understanding of the elements of a protocol and the concepts of layering
ix. Recognize the importance of networking standards and their regulatory committees
x. Describe the seven layers of the OSI model
xi. Compare and contrast the OSI model with the TCP/IP model
xii. Demonstrate understanding of the differences between circuit switching and packet switching
xiii. Understand the basic concepts of LAN and WAN technologies and topologies
xiv. Demonstrate understanding of basic concepts of error detection and correction at the data link layer
xv. Explain the different roles and responsibilities of clients and servers for a range of possible applications

ii) Cognitive/Intellectual skills/Application of Knowledge

On successful completion of this module, students will:

xvi. Understand how computer networks operate and the functions of their various components from the perspective of both users and designers.

xvii. Have a comprehensive and systematic understanding of current network architectures and their individual protocol layers, including the algorithms employed

xviii. Have a deeper and integrated understanding of selected key topics at the forefront of this field, including recent development and outstanding issues

xix. Have a critical awareness of performance issues in general and/or analytical terms and the trade-offs involved.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

On successful completion of this module, students will be able to:

xx. Implement network based on network architecture and using individual protocol layer Including details of algorithm or protocol that are used

xxi. Work out hardware and software requirements to construct a computer network.

xxii. Design and build a simple network by implementing and designing a simple network Protocol that operates at the physical and data link layers of the OSI model

xxiii. Select a range of tools that will ensure an efficient approach to implement various Client-server possibilities.

iv) General Transferable Skills

On successful completion of this module, students will be able to:

xxiv. Justify the importance of team sprit to solve a common problem.

xxv. Appreciate the importance of smooth and secured communication in normal day-to-day life.

7. Indicative Content

This module provides a comprehensive study of network architecture and individual protocol layers, including details of the algorithms or protocols that are used.

Foundation: Basic definitions used in networking (e.g. bandwidth, throughput) Network Software architecture – Computer Network Protocols. Protocol Implementation: The combination and layering of protocols; Message construction; Direct Link Networks : Hardware Building Blocks (e.g. nodes and links); Network Technologies: Ethernet; Token Rings (FDDI); Network adapter hardware; Packet Switching; Virtual circuits versus Datagrams; Congestion in networks; Routing

and related algorithms; Cell switching (e.g. ATM). Internetworking: Joining networks together; Bridging of Local Area Networks; Broadcast and Multicast; The IP protocol; Internet addresses and subnets; Structure of the global Internet; Next generation IP (IPv6); Host names and DNS; Connection establishment; Flow control; Remote Procedure Calls; End-to-End Data; Presentation of data (e.g. XDR and ASN.1); Security. Congestion Control: TCP slow start; Queuing theory High-Speed Networking: Real-time data transfer (e.g. video);

The topics covered are detailed below:

- OSI and TCP/IP reference models
- Physical layer: media and transmission
- Data link layer and medium access sub-layer
- The network layer and routing
- Transport service: TCP and UDP, socket programming
- Application layer protocols: SMTP, HTTP, NNTP
- Naming and directory services: DNS, use of DHCP
- Specification of protocols using finite state automata

8. Learning and Teaching Strategy

A course handbook will be provided in advance and this will contain in depth information relating to the course content and give an opportunity to the students to prepare the course.

The taught element of the module will be a combination of lectures, practicals and group discussions. In addition, the students will be expected to undertake a range of self-directed learning activities, which will comprise case studies and mini research projects.

- Seminar/workshop, quiz, debate competitions will be organized and students will be encouraged to participate subject to resource availability.
- Students analyze surrounding environment and find out areas where networking can solve problem or existing network can be improved.
- Students will discuss the concepts in peer groups during informal conversation and share knowledge.

9. Assessment Strategy

- Students may be asked to work on short-term networking projects in which students plan and physically implement a computer network on small scale.

- Teacher may ask students to make their own research about particular topic using library resources or internet and then produce computerized report. These reports can be assessed formatively or can be awarded as summative assessment.
- There will be comprehensive final examination (Paper-Pencil test) to give score to each student and record them for administrative purpose.

10. Assessment Pattern

Component	**Weighting (%)**	**Learning objectives covered**
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11 Strategy for feedback and student support during module

Students will be given feedback for formative assessments to tell them how they are progressing in terms of knowledge, skills and understanding of a subject. Feedback will be given to the students either during or after the assessment.

12 Indicative Resources

Core Text

- William Stalling , [ ], *Data and Computer Communication*, Prentice Hall of India, 0-13-084370-9
- William Stallings, [ ], *Cryptography and Network Security: Principles and Practice,* 3rd Edition, Pearson Education, ISBN 81-7758-011-6

Background Texts

- Andrew Whitaker, Michael Valentine, [2006], *CCNA Exam Cram*, 2nd Edition, Pearson Education , ISBN 8131701093
- Greg Hoglund, Gary McGraw, [2006], *Exploiting Software : How to Break Code*, 1st Edition, Pearson Education, ISBN 8131700836
- Stephen Northcutt, Lenny Zeltser, Scott Winters, Karen Kent Fredrick, Ronald W. Ritchey, [ ], *Inside Network Perimeter Security: The Definitive Guide to Firewalls, VPNs, Routers, and Intrusion Detection Systems*, Pearson Education

- William Stallings, [ ], *Local And Metropolitan Area Networks,* 6th Edition, William Stallings book, ISBN 0-13-012939-9

Journals

- http://www.springerlink.com/ online journal
- http://ieeexplore.ieee.org/ online journal

Key websites and on-line resources

http://www.softlookup.com/tutorial/
http://www.freetechbooks.com/
https://www.lulu.com/commerce/index.php
http://www.laynetworks.com/
http://www.groovyweb.uklinux.net/

Teaching/Technical Assistance

- One Tutorial Assistant
- One Lab Attendant

Laboratory space and equipment

- One Server
- Cat 6 Cables constructed 10 pieces and raw bundle of 100 metres
- RJ-45 connector 100 pieces
- Cable construction and testing tool
- Network devices like switch, hub, repeater etc

Computer requirements

MS-Windows Server 2003, Windows XP, ISA server 2004, Boson Network Simulator software together with multiple licenses for educational purposes.

13. Teaching Team

Mr. KAGARAMA John Baptist

Mr. NDASHIMYE Emmanuel

Mr. NAHIMANA Godefroid

Mr. TWAGILIMANA Cyprien

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 10

1. Module Code: CSC 210**.....** **SCHOOL**: SCIENCE AND TECHNOLOGY

2. Module Title: INTERNET AND WEB TECHNOLOGIES....

3. Level: 2 Semester: 2 Credits: 12

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

*** CSC105-INTRODUCTION TO COMPUTER SCIENCE**

*** CSC 205-PROGRAMMING LANGUAGES AND PARADIGMS**

6. Allocation of study and teaching hours

Total student hours: 120	**Student Hours**	**Teacher's load**
Lectures	**40**	**60**
Seminars/workshops	**10**	**10**
Practical classes/laboratory	**20**	**20**
Structured exercises	**10**	**10**
Set reading etc.	**10**	**-**
Self-directed study	**10**	**-**
Assignments – preparation and writing	**10**	**10**
Examination – revision and attendance	**10**	**10**
Other (Invigilation, Marking)		
TOTAL	120	120

6.1 Brief description of aims and content

Module consists of three courses "Internet", "Web Design and Development Tools" and "E-Commerce"

#1. This unit deals with concepts of internet, e-mails, web pages, internet protocols, equipment used for internet connectivity, providing domain names, etc.
#2. This unit deals with all the internet technologies. Student must be familiar with some of the latest concepts of internet, in-depth knowledge is not required but layery information will be enough. In response to a stated business problem, students will be able to create a complete Web-based solution. This course also covers using Dreamweaver to create Web pages.

#3. ***:*** E-Commerce describes the manner in which transactions take place of over networks, mostly on Internet. The purpose of this unit is to discuss Commerce, Benefits and Limitations, Electronic Payment System and Security implications.

6.2 Learning Outcomes

i) Knowledge and Understanding

Students who complete this course should be able to perform the following tasks:

1. Describe internet and its features
2. Configure web servers in Linux
3. Understand mobile internet technologies

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

4. Create and manage web contents and interfaces
5. Illustrate HTML codes for creating web applications

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

6. Create and format web sites using Dreamweaver
7. Understand the technical aspects, protocol functions and security issues of e-commerce.

iv) General Transferable Skills

Having successfully completed the module, students should be able to:

8. Demonstrate managerial skills
9. Justify the importance of team sprit to solve a common problem.
10. Be self contained to perform assigned tasks independently or with little guidance.
11. Complete their assigned task under tough time constraints.

7. Indicative Content

#1. Internet

- Internet characteristics, Definitions and Concepts
- ICT & Internet
- Internet networks
- Materials/equipment of connectivity (vsat, dial up, ISDN, Tx, Wlan, fiber optic etc…)
  - Internet Protocols (TCP/IP,)
  - IP Addressing and NAT
  - Networks Multi-media Web
  - Upload/Download
  - Servers: Hide/proxy, Web, ftp, DNS, email, dhcp etc…
  - Internet Security and Firewalls
  - Wimax configuration
  - Web servers & services configuration under Linux
  - The ISPs
  - Mobile Internet (Wifi, Wimax, Bluetooth, Wlan, Access point, Base Stations, bridge etc..)
- Web
  - Web Content Management
  - Sites Web, mails, sms, chart, research,
  - Multimedia Content (streaming, http, downloading)
  - Web Interface and its ergonomics
  - Domain name and Domain name Registration and Activation (local and general NIC with AfriNIC)
- Web 2
- IPv4 vs IPv6
- Internet, the web and the regulations
- Internet, the web and the ethics

#2. Web Design and Development Tools

General HTML resources link list, Moving into custom page design skills, HTML manual coding (HTML Frames, HTML style sheets), Graphics design and tools for HTML (Layout tips and optimization, Image sources available for free download and use, Optimizing image downloads (download speed vs. viewing quality), Image mapping (linking web pages and explanations to details within page images), Making animated GIF images, graphics design and tools, dynamic html, multimedia: audio, video, speech synthesis and recognition, client-side scripting, vbscript, javascript.

Creating a web site with dreamweaver, create and edit web pages with dreamweaver create web pages that include links, tables, graphics, and frames, use dreamweaver templates to create and modify web pages, insert and use dreamweaver elements in web pages, properties box, tag chooser, code a simple page in html, code view, design view, compare the code, text: colors, fonts, size, positioning, images: inserting, sizing, v-space, h-space, tables: creating, modifying, manipulating, rollovers, cascading style sheets, site structure.

#3. E-Commerce

E-Commerce and its Technological Aspects, Internet Based E-Commerce: Issues, Problems And Prospects, Electronic Payment Systems, Protocols For Electronic Payment Systems, Security Implications, Cornerstones of Security (Authenticity, Privacy, Integrity, Non-repudiation) Security mechanisms-Cryptographic techniques, Internet Security-Use of Firewalls.

8. Learning and Teaching Strategy

Theory: Formal lectures will be presented to cover the material of the course, with tutorials.

Practical: Practical exercises, examples and seminar practices will be given to workout individually/groups.

Self-study: Students are also expected to undertake at least 100 hours private study including preparation of worked solutions for tutorial classes.

9. Assessment Strategy

Formative assessment is by means of regular tutorial exercises. Feedback to students on their solutions and their progress towards learning outcomes is provided during lectures and tutorial classes. The major component of summative assessment is the written examination at the end of the module. This gives students the opportunity to demonstrate their overall achievement of learning outcomes. It also allows them to give evidence of the higher levels of knowledge and understanding required for above average marks.

10. Assessment Pattern

Component	**Weighting (%)**	**Learning objectives covered**
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		

Final Assessment Test	**40%**	**I,ii,iii,iv**

11 Strategy for feedback and student support during module

- Consultation hours to see the students in the office.
- Two meeting with the students during the semester to discuss their problems (if any).
- Analyzing the results of the tests and seminars to reach possible problems and take measures to solve them.

12 Indicative Resources

Core Text (include number in library or URL) (inc ISBN)

(1) Wille, Kohler, and Archer (1999). *Sams Teach Youself Web Development with ASP*. Sams Publishing Co.
(2) Musciano and Kennedy (2000) *HTML and XHTML: The Definitive Guide*. O'Reilly and Associates.
(3) *Susan Fowler and Victor Stanwick (2004) Web Application Design Handbook Best Practices for Web-Based Software*

13. Teaching Team

Dr. NDAYAMBAJE Pius

KAGARAMA John Baptist

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

Republic of Rwanda

HIGHER EDUCATION COUNCIL **Kigali Independent University ULK**

COMPUTER SCIENCE

YEAR 3

MODULES DESCRIPTIONS FORMS

		3rd year/ Computer Science	Credits	Hours
1.	CSC301	**English Language Skills III**	**10**	**100**
2.	CSC302	**Probability & Statistics** Unit 1: Probability Unit 2: Statistics	**10** 5 5	**100** 50 50
3.	CSC303	**Information Systems** Unit 1: Information Systems Analysis Unit 2: Information Systems Design	**10** 5 5	**100** 50 50
4.	CSC304	**Computer Architecture** Unit 1: Computer Architecture I Unit 2: Computer Architecture II	**10** 5 5	**100** 50 50
5.	CSC305	**Advanced Database Systems** Unit 1: Database Administration & Security Unit 2: Database Design II	**10** 5 5	**100** 50 50
6.	CSC306	**Networking I**	**10**	**100**
7.	CSC307	**Platform Technologies** Unit 1: Operating Systems Concepts Unit 2: Unix Operating System& Shell Progamming	**10** 5 5	**100** 50 50
8	CSC 308	**Human-Computer Interaction** Unit 1: Graphical User Interface Concepts Unit 2: GUI Design & Implementation	**10** 5 5	**100** 50 50

9	CSC309	**Object-Oriented Software Development** Unit 1: Introduction to VB.Net Unit 2: Object-Oriented Analysis & Design Using VB.NET	**10** 5 5	**100** 50 50
10	CSC310	**Research Methodology**	**10**	**100**
11	CSC311	**Networking II**	**10**	**100**
12	CSC312	**Networking III** Unit 1: Cryptography Unit 2: Network Security	**10** 5 5	**100** 50 50
		TOTAL	**120**	**1200**

MODULE 1

1. Module Code: CSC 301**.....School:** SCIENCE AND TECHNOLOGY

2. Module Title: ENGLISH LANGUAGE SKILLS III.....

3. Level: 3 Semester: 1 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

*** YEAR 1 (LEVEL 1) AND YEAR 2 (LEVEL 2) ENGLISH COURSES**

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

The objective of this course is to equip students with advanced skills for report writing and note-taking as well as strategies for intensive listening in order to increase the confidence in language use.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students should be able to demonstrate knowledge and understanding of:

1. The fundamental knowledge in English letter writing and other scientific documentary writings, and the importance of English in general

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

2. Apply the English language skills in the day-to-day life.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

3. Apply the English language skills in the day-to-day life.

iv) General Transferable Skills

Having successfully completed the module, students should be able to:

4. Share the above gathered practical skills.

7. Indicative Content

*** i:** indefinite adjectives

*** ii : conjuctions**

*** iii:** formal writing

*** iv:** composition writing

*** v:** active and passive modes

*** vi:** phrasal verbs

*** vii:** question tags

*** viii:** gerunds

*** ix:** language functions

*** x:** summarizing and paraphrasing

* xi: consolidation

8. Learning and Teaching Strategy

- Student centered:
- Face to face lectures

- giving students research topics
- Workshops

9. Assessment Strategy

-practical group class work

-Individual practical course work

-Various assignments and lastly the final examination on the general module

10. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11 Strategy for feedback and student support during module

- Each Presentation is marked, marks post on the course Web on the University Online Campus Platform, with immediate feedback (direct contact with the student or contact through the online courses platform);

- Specimen examination papers and solutions available

12 Indicative Resources

Core Text (include number in library or URL) (inc ISBN)

Indicative Reading List

ULK Centre of Languages Year 2 Text Book.

13. Teaching Team

UWERA Sauda

UMUMARARUNGU Christine

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 2

1 Module Code: .....CSC302..... **School:** SCIENCE AND TECHNOLOGY

2. Module Title: PROBABILITY & STATISTICS

3. Level: 3 Semester: 1 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

This module shows you how to calculate probabilities and statistical values. You are shown the importance of statistics in the computing world and the module includes many applications of these mathematical techniques. The module will also show you how to conduct a sample survey that will lead to valid conclusions about a population.

In addition to the basics of probability and statistics you will learn counting techniques. These techniques such as combinations and permutations are vital in many aspects of computing. Finally, you will study random numbers. These numbers are important in areas such as

cryptography. However, there is an inherent problem with using a deterministic device such as a computer to generate a non-deterministic random quantity. Hence you will discover how to test a sequence of pseudo-random numbers for true randomness and also learn of means of generating truly random numbers.

6.2 Learning Outcomes

i) Knowledge and Understanding

Upon successful completion of this module, you should be able to:

1. Use the theory of probability to estimate the likelihood of both discrete and continuous random variables ;
2. Calculate probability related parameters from raw data ;
3. Calculate summary statistics for a sample ;
4. Test statistical hypotheses ;
5. Critically evaluate sampling methodologies ;
6. Apply combinations and permutations to counting problems;
7. Differentiate truly random and pseudo random numbers and test a sequence of numbers for randomness;
8. Apply generating functions to solve practical problems;
9. Prove fundamental results such as the law of large numbers and the central limit theorem;
10. Interpret the theory of elementary random processes and apply it to a range of examples;
11. Choose and apply appropriate statistical tests for different problems, and interpret the results;
12. Explain the theoretical basis of estimation and statistical hypothesis testing.
13. Perform an elementary Bayesian analysis.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

14. An ability to perform a range of standard statistical analyses, and interpret the results of the analysis.
15. An ability to use calculus and other mathematical theory in the study of random variables and sampling distributions.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students will be able to:

16. Construct and present mathematical arguments with accuracy and clarity.

iv) General transferable skills

Having successfully completed the module, students will be able to:

17. An appreciation of data analysis, and knowledge of how to select and interpret an appropriate method of statistical analysis.
18. An understanding of the use of mathematics in statistical modelling, and an assimilation of mathematical theory studied outside this module into a statistical framework.

7. Indicative Content

Descriptive statistics: Bar charts, histograms, stem & leaf diagrams etc; mean, median, mode, standard deviation, inter-quartile range, etc. Basic data analysis using appropriate software (e.g. Minitab, Spreadsheets).
Elementary probability: Random variables (pdf, cdf), Discrete distributions (Binomial, Poisson, Geometric), Continuous univariate distributions (Normal, Exponential, Uniform), Laws of Expectation and Variance.
Elementary inference (including t-tests, chi-sqared, F-test) and Hypothesis testing. Type I and Type II errors.
Non-parametric tests including Sign, Wilcoxon, Mann-Whitney, Kolmogorov-Smirnov and Rank correlation.
Correlation and simple linear regression (least squares).

1. Learning and Teaching Strategy

The role of the lecturer is to be a facilitator. He must be always at the level of knowing what the student has understood about the subject taught. He must give clarifications so that students are able to go for research of more details. Lecturer has to give more assignment, group work and homework to students. He must try always to give case studies to students to let them digest well the subject and to know how to apply it to real life. Because of the system of students centred learning more Seminars and practical are given to students.

2. Assessment Strategy

- Lecturer may ask students to prepare presentations to encourage students to make they own research.

- Lecturer may ask students to make their own research about particular topic using library resources or internet and then produce report. These reports can be assessed formatively to give feedback to students
- Alternatively some of the assessment tools mentioned above can be used by Lecturer to award marks and record them for administrative purposes as summative assessment.
- There will be comprehensive final examination (Paper-Pencil test) to give score to each student and record them for administrative purpose.

10. Assessment Pattern

Component	**Weighting (%)**	**Learning objectives covered**
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11 Strategy for feedback and student support during module

Correction in class or in computer laboratory of written in-course tests, assignment, exercises and laboratory exercises, discussion in group work for case studies given before to students allow them to mustering the course very well.

12 Indicative Resources

Core texts

Recommended Book Resources

1. Probability and Random Processes (3rd ed), Grimmett, G. R. & Stirzaker, D. R., Oxford University Press, 2001
2. Introduction to Mathematical Statistics (6th ed), Hogg, R.V., McKean, J. W., & Craig, A.T., Prentice Hall, 2005
3. Statistics and Probability for Engineering Applications with Microsoft Excel,W.J Decoursey, 2003;
4. Mathematics HL &SL for International Baccalaureate Diploma, Peter SMTHE, 2006;
5. Schaums's Outlines – Theory and Problems of Statistics 3rd ed, M.Spiegel, L. Stephens, Murray R, 2005.

Other Resources

1. Bhattacharya, R. Theoretical Statistics. Course notes, University of Arizona Math 567A, spring 2008.
2. Casella, G. and Berger, R.L. Statistical Inference (2nd ed.). Duxbury Press, 2001.
3. Folland, G.B. Real Analysis: Modern Techniques and Their Applications (2nd ed.). Wiley-Interscience, 1999.
4. Fristedt, B. and Gray, L. A Modern Approach to Probability Theory. Birkhauser, 1997.
5. Grimmett, G. and Stirzaker, D. Probability and Random Processes, 3rd ed. Oxford, 2001.
6. Kennedy, T. Math 564. Course at University of Arizona, spring 2007.
7. Kaplan, M. and Kaplan, E. Chances Are . . . : Adventures in Probability. Penguin, 2007.
8. Moore, D.S. and McCabe, G.P. Introduction to the Practice of Statistics. Freeman and Co., 2005.
9. Royden, H.L. Real Analysis (2nd ed.). MacMillan, 1968.
10. Rudin, W. Principles of Mathematical Analysis (3rd ed.). McGraw-Hill, 1976.

13. Teaching Team

Dr KARAMBIZI Sylvestre

TWAGILIMANA Cyprien

NDASHIMYE Emmanuel

NAHIMANA Godefroid

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 3

1 Module Code: .....CSC303..... **School:** SCIENCE AND TECHNOLOGY

2. Module Title: INFORMATION SYSTEMS

3. Level: 3 Semester: 1 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

CSC204-DATABASE MANAGEMENT SYSTEM

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

The students will be able to understand the various issues involved in analyzing and designing computer based-information system in business organizations.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students will be able to demonstrate knowledge and understanding of:

1. The analysis of an information system
2. How to solve Information system problems

3. How to manage software projects as a manager

.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students will be able to:

4. Analyze Software requirement and implementation.
5. Criticize a given set of documentation for a software product.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students will be able to:

6. Analyze and design computer based information systems

iv) General transferable skills

Having successfully completed the module, students should be able to:

7. Demonstrate managerial skills.
8. Develop social and personal etiquettes to face organizational challenges and stand in leading position confidently.

7. Indicative Content

Unit I: Information Systems Analysis

Information System Overview: Common types of Information system
(Natural systems - Man-made system), Components of Automated systems (Computerized Information System), Participants to system development
System Development Life-cycle Approach: Systems Analysis, Systems Design, Programming/Coding, System Testing, Conversion, Production and maintenance
System Development Methodologies: Waterfall method, Parallel development methodology, Phased development methodology, System prototyping methodology, Rapid Application development (RAD)
Analysis of Structured System: Overview of system analysis, Nature of analysis, Importance of analysis in system's life cycle, Role and requirement of system analysts, Tools supporting analysis

Unit II: Information Systems Design

Overall Designing Specifications: Overview of structured design, Design goals and objectives, Tools and Techniques of design
Structured Design Process: The phases of design, Identification of the computer system, Model Construction
User-Computer Interface Design: Dialogue design, Outputs Design, Screen design

Design of Databases: Common problem of database design, conceptual, logical, and physical design of databases, Designing process, Physical storage structure design. Students will design and construct a physical database system to implement the logical design.

8. Learning and Teaching Strategy

Lectures will introduce the concepts of system analysis and design. The Laboratories assessments will be supervised by a Lecturer. Students will try to work sometimes independently and in group to let them digest the problem and to owner the understanding.

9. Assessment Strategy

Formative and summative assessments are organized.

In-course assessment composed of written test, assignment or homework and handled practical assignment must be organized. Students have to receive comments on their works and results where it is needed.

In-course assessment counts for 40% of the whole course marks while the final examination of 2 h 30' duration will count for 60% and cover the whole content.

10. Assessment Pattern

Component	**Weighting (%)**	**Learning objectives covered**
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11. Strategy for feedback and student support during module

During the lectures, there may be quizzes and discussions in groups with a plenary feedback. Participation will be encouraged. The presentations will be done in classes.

12 Indicative Resources

Core Text books

- Management Information Systems (12th Edition) by Kenneth C. Laudon and Carol Guercio Traver (2011)
- Database Systems: Design, Implementation, and Management by Carlos Coronel, Steven Morris and Peter Rob (2012)
- Business Driven Information Systems by Paige Baltzan (2011)
- Management Information Systems for the Information Age by Stephen Haag and Maeve Cummings (2012)
- Principles of Information Systems by Ralph Stair and George Reynolds 2011)
- Systems Analysis and Design Methods by Jeffrey Whitten and Lonnie Bentley 2005

13. Teaching Team

- **Mr. KAGARAMA J. Baptist (Team leader)**
- **Mr. NIYIKIZA Gaston (member)**

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr. SEKIBIBI Ezechiel Rector	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 4

1. Module Code: .....CSC304..... **School:** SCIENCE AND TECHNOLOGY

2. Module Title: COMPUTER ARCHITECTURE

3. Level: 3 Semester: 1 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

CSC108-COMPUTER HARDWARE TECHNOLOGY

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

This module introduces students to the organization and architecture of computer systems, beginning with the standard von Neumann model and then moving forward to more recent architectural concepts.

Topics include digital logic, data representation, assembly level organization, memory systems, interfacing and communication, functional organization, multiprocessor and alternative architectures, performance enhancements and contemporary architectures

This module will provide the student with digital logic design techniques to develop computer systems.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students should be able to demonstrate knowledge and understanding of:

On completion of the module, students should have knowledge and understanding of:

1. Digital Logic Gates
2. Computer Generations
3. Computer Building Blocks
4. Data Flow Architecture
5. Multiprocessing
6. Performance evaluation

ii) Cognitive/Intellectual skills/Application of Knowledge

On successful completion of the Module, students will have knowledge of:

7. Basic Techniques to design digital systems
8. Data representation and data flow in digital computer systems.
9. Data/ information storage in a digital computer system.
10. Multiprocessing techniques in a digital computer system.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

On completion of this module, students will be able to:

11. Solve problems involving digital systems using Kernaugh's map
12. Design combinational and sequential circuits
13. Design an arithmetic Unit of computer system
14. Design logic of a computer system

iv) General transferable skills

On completion of this module, students will be able to:

15. Using circuit maker for logic simulation
16. Implement digital systems in laboratory experiments

7. Indicative Content

- Digital logic: Fundamental building blocks (logic gates, flip-flops, counters, registers, PLA); logic expressions, minimization, sum of product forms; register transfer notation; physical considerations (gate delays, fan-in, fan-out)

• Data representation: Bits, bytes, and words; numeric data representation and number bases; fixed- and floating-point systems; signed and twos-complement representations; representation of nonnumeric data (character codes, graphical data); representation of records and arrays

• Assembly level organization: Basic organization of the von Neumann machine; control unit; instruction fetch, decode, and execution; instruction sets and types (data manipulation, control, I/O); assembly/machine language programming; instruction formats; addressing modes; subroutine call and return mechanisms; I/O and interrupts

• Memory systems: Storage systems and their technology; coding, data compression, and data integrity; memory hierarchy; main memory organization and operations; latency, cycle time, bandwidth, and interleaving; cache memories (address mapping, block size, replacement and store policy); virtual memory (page table, TLB); fault handling and reliability

• Interfacing and communication: I/O fundamentals: handshaking, buffering, programmed I/O, interrupt-driven I/O; interrupt structures: vectored and prioritized, interrupt acknowledgment; external storage, physical organization, and drives; buses: bus protocols, arbitration, direct-memory access (DMA); introduction to networks; multimedia support; raid architectures

• Functional organization: Implementation of simple data paths; control unit: hardwired realization vs. microprogrammed realization; instruction pipelining; introduction to instruction-level parallelism (ILP)

• Multiprocessor and alternative architectures: Introduction to SIMD, MIMD, VLIW, EPIC; systolic architecture; interconnection networks; shared memory systems; cache coherence; memory models and memory consistency

• Performance enhancements: RISC architecture; branch prediction; prefetching; scalability

• Contemporary architectures: Hand-held devices; embedded systems; trends in processor architecture.

8. Learning and Teaching Strategy

Basic knowledge and understanding are developed in computer practicals which contain discussion elements based on problem examples that are intended to stimulate students to research topics of interest. Skill development takes place using self-directed computer practicals based on problem themes and examples where the knowledge and understanding may be applied.

The computer practicals contain some worked examples and more presented as non-assessed exercises which are then discussed in class. The exercises are intended to reinforce the practical material. Practical notes are provided on the website and hard copies and so are problem sheets for practical exercises.

9. Assessment Strategy

(v) Learning Outcomes are evaluated using a 3 hours end-of-semester examination.

(vi) Self-directed learning is evaluated by giving the students design exercises that they will discuss in groups; solve and present during laboratory practicals

(vii) The use of appropriate referencing is evaluated in written assignments (TP)

(viii) The ability to communicate effectively using digital design strategy and methodology and to work in teams is evaluated by a group assignment where groups present prescribed topic to their peers in a practical context. The presentations and accompanying reports are evaluated by the lecturer and peer assessment in used.

10. Assessment Pattern

Component	**Weighting (%)**	**Learning objectives covered**
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11 Strategy for feedback and student support during module

(i) Examples and exercises/specimen practicals in each weekly set of self-study notes, With solutions provide for self-assessment

(ii) Each practical assignment is marked with immediate feedback

(iii) Specimen examination papers and solutions available

12 Indicative Resources

Core Text:

1. William Stallings: Computer Organization & Architecture: Design for Performance, 7th edition, Prentice Hall, 2006

2. B.Ram: Fundamentals of Microprocessors and Microcomputers, 5th edition, Dhanpat Rai Publications (P), 2001

13. Teaching Team

UWITONZE Alfred

NAHIMANA Godefroid

KAGARAMA John Baptist

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 5

1 Module Code: .....CSC305..... **School:** SCIENCE AND TECHNOLOGY

2. Module Title: ADVANCED DATABASE MANAGEMENT SYSTEMS

3. Level: 3 Semester: 1 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

*** CSC204-DATABSE MANAGEMENT SYSTEMS**

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

Understand the principles and concepts of database administration and security as well as programming and modeling issues that are central to advanced database systems.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students will be able to demonstrate knowledge and understanding of:

1. Advanced Database Management System and its related terminology
2. Raising the general level of competence in advanced Database Management System
3. Advanced Database concepts
4. Data modelling concepts
5. Best practice and quality issues of advanced Database systems are understood and implemented.
6. Designing Databases with the ORACLE tool.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students will be able to:

7. Analyze advanced database and software requirement of any organization.
8. Criticize a given set of documentation for a software product.
9. Explain RDBMS and Software Engineering concepts to future learners in effective manner

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students will be able to:

10. Given a set of informal specifications, produce a set of formal specifications for the same problem.
11. Develop and manipulate advanced databases in any available RDBMS technology ensuring fast data retrieval, data protection and security.

iv) General transferable skills

Having successfully completed the module, students should be able to:

12. Demonstrate managerial skills.
13. Develop social and personal etiquettes to face organizational challenges and stand in leading position confidently.

7. Indicative Content

Unit I: Database administration & security

Architecture of an Oracle server, Oracle database, table spaces, rollback segments, and other critical database structures, Create and maintain table spaces, partitioned tables and indexes, Managing Constraints, Managing Rollback and Temporary Segments, Administration of Control and Redo Log Files, Administer users, system and object privileges, profiles and roles, Use the Export, Import and SQL*Loader utilities, Monitor and maintain Oracle physical storage, Configure Oracle Enterprise Manager, Security Administration, Server Parameter File, Dynamic Memory Management, Segment Management, Oracle-Managed Files, Oracle Utilities and

Managing Data, Advanced principles of database administration, SQL database administration, database security, and database recovery techniques.

Unit II: Database design II

Review of Database Design, Advanced perspectives on DBMS theory, architecture and implementation, Conceptual, logical and physical modelling, Index structures for files, algorithms for query processing, Algorithms for query optimization, physical database design performance tuning, relational algebra, transaction processing and concurrency control techniques, Operational databases, decision support systems and data warehousing, Data mining concepts, stored procedures and triggers, Distributed Database and Client-server architectures, Projects in database implementation and integration.

8. Learning and Teaching Strategy

Lectures will introduce the concepts of advanced database. They will also describe some of the practical aspect of advanced database design. The Laboratories assessments will be supervised by a Lecturer. Students will try to work sometimes independently and in group to let them digest the problem and to owner the understanding.

9. Assessment Strategy

Formative and summative assessments are organized.

In-course assessment composed of written test, assignment or homework and handled practical assignment must be organized. Students have to receive comments on their works and results where it is needed.

In-course assessment counts for 40% of the whole course marks while the final examination of 2 h 30’ duration will count for 60% and cover the whole content.

10 Assessment Pattern

Component	Weighting (%)	Learning objectives covered
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final examination	**40%**	**I,ii,iii,iv**

11 Strategy for feedback and student support during module

During the lectures, there may be quizzes and discussions in groups with a plenary feedback. Participation will be encouraged. The corrections of laboratories exercises will be done in labs or in classes.

12 Indicative Resources

Core Text books

- Gerald V., [2000], Advanced *Database Management Systems,* Library Call No: 005.74 POS 1999
- Fred McFadden, Jeffery A. Hoffer, Mary Prescott, [2007], *Modern Database Management,* Eighth Edition, Prentice Hall, ISBN 0-13-221211-0

Journals

- 'A Veritable Bucket of Facts:' Origins of the Data Base Management System," ACM SIGMOD Record 35:2 (June 2006).
- Association for Computing Machinery SIGIR Forum archive Volume 7, Issue 4
- Codd, E.F. (1970). "A Relational Model of Data for Large Shared Data Banks". Communications of the ACM 13 (6): 377–387.
- The origins of the data base concept, early DBMS systems including IDS and IMS, the Data Base Task Group, and the hierarchical, network and relational data models, discussed in Thomas Haigh

13. Teaching Team

- **Mr. KAGARAMA J. Baptist (Team leader)**

- **Mr. NIYIKIZA Gaston (member)**

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
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Seen and agreed

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ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 6

1 Module Code: .....CSC306..... **School:** SCIENCE AND TECHNOLOGY

2. **Module Title:** NETWORKING I

3. Level: 4 Semester: 2 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

CSC209-DATA AND COMPUTER COMMUNICATIONS

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

Computer Networks not only provides information and resource sharing but also expedite communication between hosts. This module is aimed to provide adequate knowledge regarding computer networks and Networking devices configuration. Through this module, students will learn how to plan for computer networks, OSI and TCP/IP models and Basic Router configuration.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module; students should be able to demonstrate knowledge and understanding of:

1. Components of computer network
2. Hardware and Software requirements to construct a computer network
3. Construction and configuration of network devices
4. OSI model
5. TCP/IP model
6. International standards used in computer and networking.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

7. Compare performance of various available networking technologies and evaluate them according to their merits and demerits.
8. Explain networking concepts to future learners in effective manner.
9. Explain OSI reference model and TCP/IP (internet) model

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

10. Analyze needs of an organization and further suggest a suitable network solution.
11. Work out hardware and software requirements to construct a computer network.
12. Construct and configure computer networks at various levels.

iv) General transferable skills

Having successfully completed the module, students should be able to:

13. Justify the importance of team sprit to solve a common problem.
14. Appreciate the importance of smooth and secured communication in normal day-to-day life.

7. Indicative Content

Foundation: Basic definitions used in networking (e.g. bandwidth, throughput) Network Software architecture – Computer Network Protocols. Protocol Implementation: The combination and layering of protocols; Message construction; Direct Link Networks : Hardware Building Blocks (e.g. nodes and links); Network Technologies: Ethernet; Token Rings (FDDI); Network adapter hardware; Packet Switching; Virtual circuits versus Datagrams; Congestion in networks; Routing and related algorithms; Cell switching (e.g. ATM). Internetworking: Joining networks together; Bridging of Local Area Networks; Broadcast and Multicast; The IP protocol; Internet addresses and subnets; Structure of the global Internet; Next generation IP (IPv6); Host names and DNS; Connection establishment; Flow control; Remote Procedure Calls; End-to-End Data; Presentation of data (e.g. XDR and ASN.1); Security. Congestion Control: TCP slow start; Queuing theory High-Speed Networking: Real-time data transfer (e.g. video);

Security risks identification: Formal definitions of security, privacy, and integrity; Risk assessment and management; Information theory; Information flow and covert channels; Malicious software (e.g., viruses, logic bombs). Protection of computer systems: Coding and cryptography; Authentication methods; Capabilities, access lists, and protection domains; Standards; Audit and control methods; Legal factors; Database and inference control; Security kernels; Verification methods.

8. Learning and Teaching Strategy

- Teacher introduces available networking technologies in computer lab and demonstrates practical aspect of computer and network security.
- Seminar/workshop, quiz, debate competitions will be organized and students will be encouraged to participate subject to resource availability.
- Students analyze surrounding environment and find out areas where networking can solve problem or existing network can be improved.
- Students will discuss the concepts in peer groups during informal conversation and share knowledge.

9. Assessment Strategy

- Students may be asked to work on short-term networking projects in which students plan and physically implement a computer network on small scale.

- Teacher may ask students to make their own research about particular topic using library resources or internet and then produce computerized report. These reports can be assessed formatively or can be awarded as summative assessment.
- There will be comprehensive final examination (Paper-Pencil test) to give score to each student and record them for administrative purpose.

10. Assessment Pattern

Component	**Weighting (%)**	**Learning objectives covered**
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final examination	**40%**	**I,ii,iii,iv**

11 Strategy for feedback and student support during module

Students will be given feedback for formative assessments to tell them how they are progressing in terms of knowledge, skills and understanding of a subject. Feedback will be given to the students either during or after the assessment.

12 Indicative Resources

Core Text

- William Stalling , [ ], *Data and Computer Communication*, Prentice Hall of India, 0-13-084370-9
- William Stallings, [ ], *Cryptography and Network Security: Principles and Practice,* 3rd Edition, Pearson Education, ISBN 81-7758-011-6

Background Texts

- Andrew Whitaker, Michael Valentine, [2006], *CCNA Exam Cram*, 2nd Edition, Pearson Education , ISBN 8131701093
- Greg Hoglund, Gary McGraw, [2006], *Exploiting Software : How to Break Code*, 1st Edition, Pearson Education, ISBN 8131700836
- Stephen Northcutt, Lenny Zeltser, Scott Winters, Karen Kent Fredrick, Ronald W. Ritchey, [ ], *Inside Network Perimeter Security: The Definitive Guide to Firewalls, VPNs, Routers, and Intrusion Detection Systems*, Pearson Education

- William Stallings, [ ], *Local And Metropolitan Area Networks,* 6th Edition, William Stallings book, ISBN 0-13-012939-9

Journals

- http://www.springerlink.com/ online journal
- http://ieeexplore.ieee.org/ online journal

Key websites and on-line resources

http://www.softlookup.com/tutorial/

http://www.freetechbooks.com/

https://www.lulu.com/commerce/index.php

http://www.laynetworks.com/

http://www.groovyweb.uklinux.net/

Teaching/Technical Assistance

- One Tutorial Assistant
- One Lab Attendant

Laboratory space and equipment

- One Server
- Cat 6 Cables constructed 10 pieces and raw bundle of 100 metres
- RJ-45 connector 100 pieces
- Cable construction and testing tool
- Network devices like switch, hub, repeater and Router.

Computer requirements

Personal computers with Windows XP or Win 7, Packet tracer Simulator software together with multiple licenses for educational purposes.

13. Teaching Team

Mr. NDASHIMYE Emmanuel, Module Leader

Mrs Dr NDAYAMBAJE Pius

Mr. KAGARAMA John Baptist

Mr. NDAHIMANA Godefroid

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 7

1 Module Code: .....CSC307..... **School:** SCIENCE AND TECHNOLOGY

2. Module Title: PLATFORM TECHNOLOGIES

3. Level: 4 Semester: 2 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

CSC306-NETWORKING I

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

Upon completion of this module the students will understand basic knowledge on using, evaluating, and managing existing operating systems.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module; students should be able to demonstrate knowledge and understanding of:

1. Operating system and function, Evolution of operating system, Batch, Interactive, Time Sharing and Real Time System, System protection.
2. Operating System Structure
3. Concurrent Processes
4. CPU Scheduling

5. Deadlock
6. Memory Management
7. I/O Management & Disk Scheduling

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should develop the following cognitive skills:

8. The Ability of describing UNIX Operating System such as UNIX commands, files and directories, text editing, electronic mail, pipes and filters, shell environments, scripting and programming in the UNIX environment.

9. The Ability of understanding Unix System kernel and Utilities, File & Directions.

10. The ability of knowing various UNIX Shell Programming including : Bourne Shell, korn shell and C shell.

11. Understanding Shell meta characters, shell variable and scripts, facilities and command, environment.

12. Ability of explaining Integer arithmetic and string manipulation, decision making, aliasing, arrays and job control.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

13. Unix System Administration such as File System mounting and unmounting.

14. System booting, shutting down.
15. Handling user account, backup and recovery.
16. Handle Security issues.
17. Deal with terminals management.
18. Printer and modem management.
19. Use text formatting such as tools troff, nroff, tbi, pie and aqn.
20. Use Language Development Tool such as Yacc, Lex and M4.
21. Use debuggers Dbx, Adb,Sdb,Strip and Ctrace.

iv) General transferable skills

Having successfully completed the module, students should be able to Share skills in those studied courses.

7. Indicative Content

UNIT I: OPERATING SYSTEMS CONCEPTS

Introduction: Operating system and function, Evolution of operating system, Batch, Interactive, Time Sharing and Real Time System, System protection.

Operating System Structure: System Components, System structure, Operating System Services.

Concurrent Processes: Process concept, Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Classical problems in Concurrency, Inter Process Communication, Process Generation, Process Scheduling.

CPU Scheduling: Scheduling Concept, Performance Criteria Scheduling Algorithm, Evolution, Multiprocessor Scheduling.

Deadlock: System Model, Deadlock Characterization, Prevention, Avoidance and Detection, Recovery from deadlock combined approach.

Memory Management: Base machine, Resident monitor, Multiprogramming with fixed partition, Multiprogramming with variable partition, Multiple base register, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replaced algorithm, Allocation of frames, Thrashing, Cache memory, Organization, Impact on performance.

I/O Management & Disk Scheduling: I/O devices and organization of I/O function, I/O Buffering, DISK I/O, Operating System Design Issues.

File System: File Concept, File Organization and Access Mechanism, File Directories, File Sharing, Implementation Issues.

UNIT II: UNIX OPERATING SYSTEM & SHELL PROGRAMMING

UNIX Operating System: UNIX commands, files and directories, text editing, electronic mail, pipes and filters, shell environments, scripting and programming in the UNIX environment.

UNIX Diversion: Unix System kernel and Utilities, File & Directions, Single & Compound Statement Command Library and Include files.

Unix System Administration: File System mounting & Unmounting, System booting, shutting down, handling user account, backup, recovery, security, terminals, printer and modem.

Different Tools & Debugger : System development tool, Lint, Make, SCCS (source code control ,system),Language Development Tool – Yacc, Lex and M4, text formatting, tools troff, nroff, tbi, pie and aqn, debuggers Dbx, Adb,Sdb,Strip and Ctrace.

UNIX Shell Programming: Bourne Shell, korn shell and C shell. Shell metacharacters, shell variable and scripts, facilities and command, environment, integer arithmetic and string manipulation, decision making, aliasing, arrays and job control.

10. Learning and Teaching Strategy

- Teacher introduces available Computer with both UNIX and MS Windows operating systems in the lab and demonstrates practically how OS work.

- Seminar/workshop, quiz, debate competitions will be organized and students will be encouraged to participate subject to resource availability.
- Students will discuss the concepts in peer groups during informal conversation and share knowledge.

11. Assessment Strategy

- Students may be asked to work on short-term computer Operating system projects in which students plan and physically implement a project on his/her capability.
- Teacher may ask students to make their own research about particular topic using library resources or internet and then produce computerized report. These reports can be assessed formatively or can be awarded as continuous assessment.
- There will be comprehensive final examination to give score to each student and record them for administrative purpose.

10. Assessment Pattern

Component	**Weighting (%)**	**Learning objectives covered**
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final examination	**40%**	**I,ii,iii,iv**

11 Strategy for feedback and student support during module

Students will be given feedback for formative assessments to tell them how they are progressing in terms of knowledge, skills and understanding of a subject. Feedback will be given to the students either during or after the assessment.

12 Indicative Resources

Core Text

- OPERATING SYSTEMS DESIGN AND IMPLEMENTATION, BY ANDREW S. TANENBAUM.
- MODERN OPERATING SYSTEMS ,SECOND EDITION BY ANDREW S. TANENBAUM

- SYSTEMS PROGRAMMING AND OPERATING SYSTEMS SECOND EDITION BY DM DHAMHERE.

Key websites and on-line resources

http://www.doc.ic.ac.uk /~wjk

http://www.personal.kent.edu/~muhamma/opsystems/Myos

http://users.ox.ac.uk/~martinw/unix

Teaching/Technical Assistance

The ULK Computer Lab, Lecturer and One Lab Attendant will be required for Computer Practices on Presentations Techniques as well as on Performance Analysis and Practical Assignments.

Laboratory space and equipment

- 40 complete working computers with both Unix Os and one of Ms Windows OS.
- Internet connection.

13. Teaching Team

Dr. NDAYAMBAJE PIUS

Mr. KAGARAMA JOHN BAPTIST

Mr. NAHIMANA GODEFROID

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 8

1. Module Code: CSC 308**..... School:** SCIENCE AND TECHNOLOGY

2. Module Title: HUMAN COMPUTER INTERACTION

3. Level: 4 Semester: 2 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

*** CSC205-PROGRAMMING LANGUAGES AND PARADIGMS**

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

This module is aimed to introduce students to the fundamentals of human computer interface, to demonstrate how the human memory, perception, attention, communication skills and skills acquisition are motivating factors for studying Human Computer Interaction. In particular students will acquire competencies in design, implementation and evaluation of computer interfaces.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students should be able to demonstrate knowledge and understanding of:

i. Importance of computer interface and usability
ii. Human Information Processing and its relevance to the usability of computer interface
iii. Usability guidelines in User Interface design
iv. Importance of prototyping , guidelines of graphic design, implementation models
v. Different ways of evaluating a user interface

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

vi. Discover the user centered Model/Approach to user interface development
vii. Successfully perform task analysis
viii. Apply the concepts and skills learned to solving real world problems
ix. Design, implement and evaluate any solution related to human computer interface for companies and institutions

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

x. Present their ideas to a general audience using reasonable written and oral communication skills.
xi. Use numerical and statistical methods to solve Computational problems.
xii. Apply the concepts and skills learned into practical field.

iv) General transferable skills

Having successfully completed the module, students should be able to:

xiii. Propose a scheme of solution to any problem related to human computer interaction
xiv. Participate effectively in the development of front-end (presentation layer) components in any project of ICT

7. Indicative Content

Graphical User Interface concepts : Introduction to the features of event driven programming to create sophisticated presentation/view applications to solve the problems. Importance of User Interface and Usability and usability engineering.

Interface Design: User centered design, Task analysis, User Interface Software Architecture(Model-View-Controller, View Hierchrchy, Observer Pattern), Human Information

Processing Capabilities(Human Information Processor Model, Perception, motor skills, color, attention, and errors) and using those capabilities to drive design techniques; usability guidelines, interaction styles and graphic design principles.

Interface Implementation: Techniques for building user interfaces, including low-fidelity prototypes and other prototyping tools, input models, output models, model-view-controller, layouts, constraints, and toolkits.

Evaluation: Techniques for evaluating and measuring interface usability, including heuristic evaluation, predictive evaluation, and user testing.

8. Learning and Teaching Strategy

The lecturer will give clarifications so that students are able to go for research of more details. He has to give more assignments, group works and homework's to students. He must try always to give case studies to students to let them digest well the subject and to know how to apply it to real life.

9. Assessment Strategy

- As formative assessment tools, students may be asked to make oral presentations, write essay/short notes etc.
- Students may be asked to work on short-term software/database projects.
- Teacher may ask students to make their own research about particular topic using library resources or internet and then produce computerized report. These reports can be assessed formatively or can be awarded as summative assessment.
- There will be comprehensive final examination (Paper-Pencil test) to give score to each student and record them for administrative purpose.

10. Assessment Pattern

Component	**Weighting (%)**	**Learning objectives covered**
In-course assessment (CAT):		
Continuous Assessment Test 1	**30%**	**I,ii,iii,iv**
Continuous Assessment Test 2	**30%**	**I,ii,iii,iv**
Final assessment:		
Final Assessment Test	**40%**	**I,ii,iii,iv**

11 Strategy for feedback and student support during module

Students will be given feedback for formative assessments to tell them how they are progressing in terms of knowledge, skills and understanding of a subject. Feedback will be given to the students either during or after the assessment.

Teaching team will re-evaluate teaching methods for problematic area and work toward improving student learning.

12 Indicative Resources

Core Text

- Gregory D. Abowd, Alan Dix, Janet E. , Finlay, Russel Beale, [2007]*Human Computer Interaction, fourth Edition*, ISBN 912pp 0-13-239048-5 / 978-0-13-239048-4 Hbk, Prantice Hall
- J. Preece et al., *Human Computer Interaction*, Pearson Education.
- Caroll, J. Human Computer Interaction in the new Millenium, 2001, Addison Wesley Pub Co, ISBN:0201704471
- Nielsen, J. Usability Engineering, AP Professional, 1993, ISBN: 0125184069

Teaching/Technical Assistance

- 1 Lab Attendant

13. Teaching Team

Dr. NDAYAMBAJE Pius

Mr Kagarama John Baptist

Mr Niyikiza Gaston

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 9

1. Module Code: CSC 309**..... School:** SCIENCE AND TECHNOLOGY

2. Module Title: OBJECT-ORIENTED SOFTWARE DEVELOPMENT

3. Level: 4 Semester: 2 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

*** CSC205-PROGRAMMING LANGUAGES AND PARADIGMS**

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

The students will be able to apply system development principles using an object-oriented language to program complex systems and develop team skills as well as software reliability and quality assurance

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students will be able to demonstrate knowledge and understanding of:

i. Object oriented Software Development and its related terminology
ii. Raising the general level of competence in Object oriented Software Development
iii. Object oriented Software Development concepts
iv. Best practice and quality issues of Object oriented Software Development are understood and implemented.
v. Connecting the application with the database using Ms SQL Server.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students will be able to:

vi. Analyze Object oriented Software requirement and implementation.
vii. Criticize a given set of documentation for a software product.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students will be able to:

viii. Given a set of informal specifications, produce a set of formal specifications for the same problem.
ix. Develop an object oriented application and connect it with the database using Ms SQL Server.

iv) General transferable skills

Having successfully completed the module, students should be able to:

x. Demonstrate managerial skills.
xi. Develop social and personal etiquettes to face organizational challenges and stand in leading position confidently.

7. Indicative Content

Unit I: Visual Basic.net Programming

User Interface Design, Programming Life Cycle, Structured Programming, Object-Oriented Programming and Design, and Flow Charts, simple programs in Visual Basic, data types,

computer memory concepts, use arithmetic operators, arithmetic operators, simple decision-making statements, and Active X controls, basic problem-solving techniques, develop algorithms, if/then and if/then/else selection structures, while/when, do while/loop and do until/loop repetition structures, counter-controlled repetition and sentinel-controlled repetition, nested control structures,for/next, do/loop while and do/loop until, multiple selection using select case, exit do and exit for statements, Boolean data type, constant variables, logical operators, control structures combined in a structured program,construct programs modularly from procedures and functions, create new procedures and functions, mechanisms used to pass information between procedures and functions, exit sub and exit function statements, simulation using random numbers, recursion, understand and use optional arguments and named arguments, use VB math functions, create and use code modules, array data structure, use of arrays to store, sort, and search lists and tables of values, understand how to declare and array, initialize an array, individual elements of an array, pass arrays to procedures, understand basic sorting techniques, create and manipulate multidimensional arrays, create and use control arrays, redimension dynamic arrays, ParamArray and Array, string concatenation operators, strings and search strings for substrings, characters in a string, convert values from strings and other data types, use date and time functions, be able to format strings, dates and times.

Unit II: Object-Oriented Software Design &Testing

Object-Orientation & Modelling Concepts: Basic Concepts, The Origins of Object-Orientation,Object-Orientated languages, Models and diagrams, Drawing Activity Diagrams.

Requirements Capture &Analysis:: Used Requirements, Finding Techniques, User Involvement, Documenting Requirements, Use Cases, Requirements Capture and Modelling, Requirements Model, Use Case Realization, Class Diagram, CRC (Class Responsibility Collabaration) Cards, Assembling the Analysis Class Diagram.

Refining the Requirements Model: Component-based Development, Adding Further Structure, Software Development Patterns.

Object Interaction: Object Interaction and Collaboration, Interaction Sequence Diagrams, Collaboration Diagrams, Model Consistency.

Specifying Operations: Introduction,The Role of Operation Specifications, Contracts, Describing Operation Logic, Object Constraint Language, Creating an Operation Specification.

Specifying Control: States and Evens, Basic Notation, Further Notation, preparing a Statechart, Consistency Checking, Quality Guidelines, Summary.

System Design: Measurable Objectives of Analysis and Design, Measurable Objectives in Design, Planning for Design, Software Architecture Concurrency, Processor Allocation, Data Management Issues, Development Standards, Prioritizing Design Trade-offs, Design for Implementation. **Object Design & Design Patterns**:: Class Specification, Interfaces, Criteria for Good Design, Designing Associations, Integrity Constraints, Designing Operations, Normalization, Software Development Patterns, Documenting Patterns-pattern Templates, Design patterns, How to Use Design Patterns, Benefits and Dangers of Using patterns, Designing Boundary Classes: Introduction, The Architecture of the Presentation Layer, Prototyping the User Interface, Designing Classes, Designing Interaction with <sequence <<diagrams, The Class Diagram Revisited, User Interface Design Patterns, Modelling the Interface Using Statecharts.

Software Testing: Testing context, Risk analysis, Basic object-oriented concepts, Testing analysis and design models, Testing classes, Testing State-based classes, Parallel architecture for component testing, Planning for component testing, Measuring the effectiveness of component testing, System testing, Organizing for testing.

8. Learning and Teaching Strategy

Lectures will introduce the concepts of Object oriented Software Development. They will also describe some of the practical aspect of Object oriented Software analysis and design. The Laboratories assessments will be supervised by a Lecturer. Students will try to work sometimes independently and in group to let them digest the problem and to owner the understanding.

9. Assessment Strategy

Formative and summative assessments are organized.

In-course assessment composed of written test, assignment or homework and handled practical assignment must be organized. Students have to receive comments on their works and results where it is needed.

In-course assessment counts for 40% of the whole course marks while the final examination of 2 h 30' duration will count for 60% and cover the whole content.

10. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
CATs	**60**	**1-4**
Final Assessment Test	**40**	**1-4**
Total	**100**	

11 Strategy for feedback and student support during module

During the lectures, there may be quizzes and discussions in groups with a plenary feedback. Participation will be encouraged. The corrections of laboratories exercises will be done in labs or in classes.

12 Indicative Resources

Core Text books

- An Introduction to Object-Oriented Programming with Visual Basic.NET by Dan Clark
- Programming and Problem Solving With Visual Basic.Net by Nell B. Dale
- Visual Basic .NET How to Program (2nd Edition) by Harvey M. Deitel, Paul J. Deitel, Tem R. Nieto
- Gerald V., [2000], Advanced *Database Management Systems,* Library Call No: 005.74 POS 1999

13. Teaching Team

Mr Kagarama John Baptist (Team Leader)

Mr Niyikiza Gaston (Member)

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 10

1. **Module Code:** CSC 310**..... School:** SCIENCE AND TECHNOLOGY
2. **Module Title:** RESEARCH METHODOLOGY

3. Level: 4 Semester: 2 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

This module aims to develop an understanding of research methodology and the process of research to enable students to effectively undertake the dissertation. At the end of this module students will develop a minor project in the field of ICT.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students should be able to:

1. Understand various approaches to research.
2. Design a research programme and draft the research proposal suitable for submission to a funding body.
3. Identify information needs for research work and access the relevant information.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

4. Act as a productive member of a research team.
5. Undertake an appropriate analysis and give a correct interpretation of a complex problem.
6. Demonstrate the ability to write technical reports and research papers.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

7. Demonstrate the ability to deliver an oral presentation to an informed audience.
8. Designing a minor project in the filed of ICT
9. To get real time work experience and problem solving skills in the industry by having onsite industrial training

iv) General transferable skills

Having successfully completed the module, students should be able to:

10. Demonstrate critical analysis of a published research paper and act appropriately in context.

7. Indicative Content

Scientific and ethnographic models for research

The Research Process; theory and practical implications

Selection and Identification of the Research Topic, Definition of Research Objectives, Formulation of Research Questions and Hypotheses

Review of Relevant Literature and Existing Research: Literature Searches; Effective Use of the Internet and library materials, and organization of material.

Risk assessment and management, Planning and Budgeting

Deciding the Research Strategy and Design

The Research Proposal and Plan

Ethical considerations for researchers

Issues of reliability, validity and generalisability for researchers

Features of Qualitative and Quantitative Data

Collection of Primary Data: Experimental Design, Survey Methods, Sampling Design and Procedure.

Analysis of quantitative data ; an overview of statistical procedures.

Use of secondary data in the research process

Collection and Analysis of Qualitative Data; Interviewing and Observation Methods.

Communicating your Results Effectively: Dissertation Structure and Presentation

Designing and developing a minor project in the field of ICT.

8. Learning and Teaching Strategy

Students will be guided in their learning using a combination of learning and teaching methods:

1. Lecture: The students will be introduced to the concepts in this module through a series of lectures accompanied by clarifying examples. These periods will also provide a forum for discussion and debate.

2. Student-centred learning Students are expected to undertake directed independent study by reading through lecture notes, recommended chapters/sections from the module text and other recommended sources.

3. Group activities: Students will have the opportunity to work in small groups of three towards completion of a mini research project. The project will comprise preparing a research proposal, critical review of a research paper, testing and the analysis of raw data, preparing a technical report and a research paper, and delivery of a group seminar. It is expected that by completion of the module, students will show their skills in relation to research activities.

4. Practical sessions As part of the research project, students are required to carry out practical work, which involves both manufacturing and testing. These sessions provide further opportunity for student to gain hand-on experience on various manufacturing and testing equipment.

Students will be expected to use IT in completing coursework elements of the module.

9. Assessment Strategy

- Research Proposal
  Each group is required to complete a pre-formatted research proposal form on the allocated research project. The proposal form seeks answers to the following sections:

  · Rationale for the research work.
  · Nature, scope, and the range of research activities.
  · Plan of the research work

- · Budgeting.

2. Critical Review of a Research Paper
To use the time effectively, each group will be provided with three published research papers on the topic of the group project. Each group member will be responsible to critically analyse one research paper and prepare a critical review of the paper in no more than 1500 words. A group effort is then required in preparing an article of no more than 700 words placing the project in the context of the research papers.
Reviews should be typewritten, collated and submitted to the concerned Lecturer

- 3. Technical Report
Upon the completion of the group project, each group should submit a typewritten project report of no more than 25 pages (including figures, diagrams, tables, etc.) to the Lecturer. The report must be organised as stipulated in the lectures (e.g. mechanics of writing) and the data should be analysed statistically and presented using the IT facilities available in the University.

4. Research Paper
Each group must summarise the content of the technical report and write a research paper of no more than 3000 words. The research paper must be prepared according to the sample provided and should be submitted to Lecturer on time.

10. Assessment Pattern

Component	**Weighting (%)**	**Learning objectives covered**
CATs	**60**	**1-4**
Final exam	**40**	**1-4**
Total	**100**	

11 Strategy for feedback and student support during module

Students will be given feedback for formative assessments to tell them how they are progressing in terms of knowledge, skills and understanding of a subject. Feedback will be given to the students either during or after the assessment.

Teaching team will re-evaluate teaching methods for problematic area and work toward improving student learning.

12 Indicative Resources

Core Text (include number in library or URL) (inc ISBN)

Weaver, P. (2004). *Success in your Project: a Guide to Student System Development Projects.*, Prentice-Hall

Galliers, R. (1992). *Information Systems Research: Issues, Methods and Practical Guidelines*, Blackwell Scientific

Cornford, R. and Smithson, S. (1996). *Project Research in Information Systems: A Students Guide*, Macmillan

Dawson, C. (2000). *The Essence of Computing Projects, a Students' Guide*, Pearson

Blaxter, L., Hughes, C. & Tight, M. (1998). *How to Research*, OU Press

Background Texts (include number in library or URL) (inc ISBN)

Gillham, B. (2000). *The Research Interview*, Continuum

Gillham, B. (2000). *Developing a Questionnaire*, Continuum

Gillham, B. (2000). *Case Study Research Methods*, Continuum

Kumar, R. (1999). *Research Methodology A Step-by-Step Guide for Beginners*, Sage

13. Teaching Team

Dr. NDAYAMBAJE Pius

NAHIMANA Godefroid

NIYIKIZA Gaston

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 11

1. Module Code: CSC 311**..... School:** SCIENCE AND TECHNOLOGY

2. Module Title: NETWORKING II

3. Level: 4 Semester: 2 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

*** CSC306-NETWORKING I**

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

The aim of this module is to introduce routing protocols and switching. The goal is to develop an understanding of how a router learns about remote networks and determines the best path to those networks. This course includes both static routing and dynamic routing protocols.

6.3 Learning Outcomes

I) Knowledge and Understanding

Having successfully completed the module, students should be able to:

1. Understand Routing and Packet Forwarding
2. Understand Static Routing and Cisco Discovery Protocol

3. Understand Dynamic Routing Protocols
4. Understand Distance Vector Routing Protocols

II) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

5. Understand VLSM and CIDR (Variable Length Subnet Mask) and Classless Inter-Domain Routing, the role and benefits of CIDR in today's networks.
6. Understand RIP version and of RIPv2

III) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

7. Understand VLSM and CIDR (Variable Length Subnet Mask) and Classless Inter-Domain Routing, the role and benefits of CIDR in today's networks.
8. Understand RIP version and of RIPv2

IV) General transferable skills

Having successfully completed the module, students should be able to:

9. Understand the Cisco Enhanced Interior Gateway Routing Protocol (EIGRP).
10. Understand Link-State Routing Protocols; link-state routing protocol concepts. And then examine the Open Shortest Path First (OSPF) protocol
11. Develop an understanding of how switches are interconnected and configured to provide network access to LAN users.
12. Understand VLAN, VTP, STP, inter-VLAN routing

7. Indicative Content

Unit 1: Routing protocols

Routing and Packet Forwarding; introduction, role and component of the router, and the packet forwarding process, routing table.

Static Routing, role and configuration, Cisco Discovery Protocol (CDP),

Dynamic Routing Protocols, overview routing protocol, various dynamic routing protocols available for routing in IP networks, classification of dynamic routing protocols, comparing and contrasting the different protocols.

Distance Vector Routing Protocols, two different types of routing protocols, distance vector and link-state concepts and operations, routing loops.

VLSM and CIDR (Variable Length Subnet Mask) and CIDR (Classless Inter-Domain Routing. the role and benefits of CIDR in today's networks.

RIP version 1 and 2, the characteristics, operations, limitations, configuration, verification, and troubleshooting techniques of RIPv1 and RIPv2.

Cisco EIGRP (Enhanced Interior Gateway Routing Protocol), advantages and operations of EIGRP's DUAL (Diffusing Update Algorithm).

Link-State Routing Protocols, link-state routing process, benefits and advantages of a link-state routing protocol compared to a distance vector routing protocol, Open Shortest Path First (OSPF) algorithm, operations, and configuration.

Unit 2: LAN Switching

LAN Design, hierarchical network design.

Basic Switch Concepts and Configuration ,switch forwarding methods,Layer 2 and Layer 3 switching, initial switch configuration.

VLANs, types of VLANs, VLAN trunks with IEEE 802.1Q tagging facilitate inter-switch communication with multiple VLANs.

VLAN Trunking Protocol VTP types and VTP domain.

Spanning Tree Protocol and SPT implementation.

Inter-VLAN Routing, methods of inter-VLAN routing.

8. Learning and Teaching Strategy

Theory: Formal lectures will be presented to cover the material of the course, with tutorials.

Practical: Practical exercises, examples and seminar practices will be given to workout individually/groups.

Self-study: Students are also expected to undertake at least 100 hours private study including preparation of worked solutions for tutorial classes.

9. Assessment Strategy

Assessment criteria

- Knowledge and critical understanding of theory.
- Ability to solve relevant problems.
- Ability to write and deliver presentations in appropriate language.
- Ability to perform laboratory experiments, interpret results and write reports.
- Problem solving skills.

All assessment methods try to force the learner to demonstrate his / her ability to think through unseen problems.

10. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
CATs	**60**	**1-4**
Final exam	**40**	**1-4**
Total	**100**	

11 Strategy for feedback and student support during module

- Consultation hours to see the students in the office.
- Two meeting with the students during the semester to discuss their problems (if any).

Analyzing the results of the tests and seminars to reach possible problems and take measures to solve them.

12 Indicative Resources
Core Text (include number in library or URL) (inc ISBN)

J.Irvine & D.Harle () Data Communications & Networks: An Engineering Approach", , Wiley

CISCO materials (CCNA2 and 3)

13. Teaching Team

Dr NDAYAMBAJE Pius

NAHIMANA Godefroid

NDASHIMYE Emmanuel

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 12

1. Module Code: CSC 312**..... School:** SCIENCE AND TECHNOLOGY

2. Module Title: NETWORKING III

3. Level: 4 Semester: 2 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

*** CSC311-NETWORKING II**

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

This course provides an essential study of computer security issues and methods in networking systems. Topics to be covered include: Prime numbers, Conventional and modern Encryption, Advanced encryption standard, Public Key Encryption and Authentication, Security configuration Practice, System Security, data from unauthorized or accidental access, modification and denial of service.

Keywords: Number system, encryption Techniques, encryption standard, private & public key cryptosystems, Digital signatures and Authentication Applications.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students should be able to demonstrate knowledge and understanding of:

1. Fundamental concepts of data encryption /decryption in computer security
2. Design and develop authentication systems and security systems
3. Professional ethical legal responsibilities of computer security engineers
4. Social impact of computer security in online transactions, e-commerce and E-management.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed this unit, students should be able to:

5. Use principles of encryption /decryption and authentication in the development of solutions to problems in computer security
6. Apply known encryption /decryption and authentication algorithms to produce innovative designs of computer security products
7. Critically assess work done by other security developers before
8. Apply knowledge of computer security to produce technical risk assessment
9. Apply knowledge gained on security to produce commercial risk assessment
10. Apply technical and professional information gained on computer security to access social impact of security practices

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

11. use competently and safely any security related monitoring instruments
12. analyse and interpret password etc.. And apply them to solutions of Security related problems in computers
13. plan installation and maintenance of computer hardware and Software security systems
14. demonstrate awareness of programming for security
15. demonstrate practical applications of computer security hardware and Software

iv) General transferable skills

Having successfully completed the module, students should be able to:

16. efficiently manage time and resources in maintaining computer Security
17. demonstrate problem solving skills specific to data security

7. Indicative Content

Unit1: Cryptography : Fermat's and Euler's theorem, Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman key exchange algorithm, Introductory idea if Elliptic curve cryptography Authentication requirements, Message authentication codes, Hash functions, Digital signatures.

Unit2: Security Concepts and Terminology: Overview of Services, Mechanisms and Attacks, Classical Encryption Techniques-Cipher model, substitution techniques, transportation techniques, rotor machines, stenography, Block ciphers. Advanced encryption standard-AES cipher, Triple DES, Blowfish, RC5, and Traffic Confidentiality.

Unit3: Authentication Mechanisms: Authentication Applications, Kerberos & X.509, Electronic Mail security, IP security- Architecture, Authentication Header, Encapsulating security payloads, Web Security- Secure Socket Layer & Transport Layer Security, Secure Electronic Transaction (SET).

Unit4: Cryptographic Protocols: Intruders, Intrusion Detection, Password Management, Malicious Software- virus, worms, and related threats, virus counter measures, Firewall design principles, and trusted systems.

Unit5: Wireless Security Mechanisms and Recent security Applications

8. Learning and Teaching Strategy

A course handbook will be provided in advance and this will contain in depth information relating to the course content and give an opportunity to the students to prepare the course.

The module will be delivered through lectures, tutorial/practice sessions and group discussions. In addition to the taught element, students will be expected to undertake a range of self-directed learning activities, which will comprise case studies and mini research projects. All supporting documents for the course will be made available as printed copies and also as soft copies.

9. Assessment Strategy

Assessment on the programme is undertaken in accordance with the current Academic Regulations of the University.

Assessment Criteria:

- For the examination setting and marking the ULK generic marking criteria will be used.
- For the assignment, criteria will be drawn up appropriate to the topic, based on the ULK generic marking criteria

10. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
CATs	**60**	**1-4**
Final exam	**40**	**1-4**
Total	**100**	

11 Strategy for feedback and student support during module

- INTERACTIVE LECTURING STYLE, WITH OPPORTUNITIES FOR QUESTIONS, AND REQUIREMENT TO WORK ON SIMPLE PROBLEMS.
- Peer marking of tutorial questions for formative feedback.

- Tutorial classes where students can ask questions and be lead through solutions as required.
- Opportunities to consult lecturer and/or tutorial assistant in office hours.

12 Indicative Resources

Core Text (include number in library or URL) (inc ISBN)

1. William Stallings, Cryptography and Network Security Principles and Practices, Fourth Edition**, November 16, 2005.** w Jersey. Johannes
2. Buchmann, "Introduction to cryptography", Springer Verlag. Bruce Schiener, "Applied Cryptography".
3. William Stallings. Network Security Essentials (2nd edition). Prentice Hall. 2003. (ISBN: 0130351288)
4. Saadat Malik, Saadat Malik. Network Security Principles and Practices (CCIE Professional Development). Pearson Education. 2002. (ISBN: 1587050250)
5. Andrew S. Tanenbaum, **Computer Networks, Fourth Edition, 2003.**

Key websites and on-line resources

Teaching/Technical Assistance

Lecturer,

13. Teaching Team

Mr. NDASHIMYE Emmanuel, Module Leader

Mr. NAHIMANA Godefroid, member

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
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Seen and agreed

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ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

Republic of Rwanda

HIGHER EDUCATION COUNCIL **Kigali Independent University ULK**

COMPUTER SCIENCE

YEAR 4

MODULES DESCRIPTIONS FORMS

		4th Year Computer Science	**Credits**	**Hours**
1.	CSC401	**Numerical Analysis & Applications**	**10**	**100**
		Unit 1: Numerical Methods	5	50
		Unit 2: Numerical Analysis & Programming	5	50
2.	CSC402	**Computer Graphics & Vision**	**10**	**100**
		Unit 1: Computer Graphics	5	50
		Unit 2: Computer Vision	5	50
3.	CSC403	**Formal Languages & Automata**	**10**	**100**
		Unit 1: Formal Languages	5	50
		Unit 2: Automata Theory	5	50
4.	CSC404	**Intelligent Systems**	**10**	**100**
		Unit 1: Artificial Intelligence	5	50
		Unit 2: Expert Systems	5	50
5.	CSC405	**Software Engineering**	**10**	**100**
		Unit 1: Principles of Software Design	5	50
		Unit 2: Software Project Management	5	50
6.	CSC406	**Entrepreneurship Development**	**10**	**100**
7.	CSC407	**Operational Research**	**10**	**100**
		Unit 1: Linear Programming	5	50
		Unit 2: Optimization Techniques	5	50
8.	CSC408	**Internship**	**10**	**100**

9.	CSC409	**Distributed Computing Systems**	**10**	**100**
		Unit 1: Distributed Systems	5	50
		Unit 2: Parallel Computing	5	50
10	CSC410	**Data Mining & Warehousing**	**10**	**100**
		Unit 1: Data Mining	5	50
		Unit 2: Data Warehousing	5	50
11	CSC411	**Wireless Networks & Mobile Computing**	**10**	**100**
		Unit 1: Wireless Networks	5	50
		Unit 2: Mobile Computing	5	50
12	CSC412	**Dissertation**	**10**	**100**
		TOTAL	**120**	**1200**

MODULE 1

1. **Module Code:** CSC 401**..... School:** SCIENCE AND TECHNOLOGY
2. **Module Title:** NUMERICAL ANALYSIS AND APPLICATIONS

3. Level: 5 Semester: 1 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

Numerical analysis is *the study of algorithms for the problems of continuous mathematics* (formulation due to L. Trefethen in 1992). Algorithms are systematic ways to perform a task by breaking it into basic steps done in a specified order. Problems in continuous mathematics are typically to do with numbers that can only be found approximately: e.g., find a root of a complicated equation f(x)=0, or approximate the solution of a differential equation over an interval. They arise in a wide variety of settings: physics, weather prediction, operational research, finance, all braHECs of engineering, etc. It is one of the triumphs of numerical analysis since the 1940s to have speeded up reliable algorithms for some problems (such as partial differential equations) by orders of magnitude, independently of the increasing speed of

the computers they run on. It remains important to understand the underlying theory and to be able to evaluate the accuracy and efficiency of methods.

This module serves as a first course in numerical analysis and its relationship with computers. It involves studying some fundamental numerical methods, including polynomial interpolation, solving equations in one real variable, numerical integration, and solving ordinary differential equations (ODEs). The module provides a foundation for the study of further numerical analysis in subsequent years and is of relevance to students with interests in any area of applied mathematics.

This module covers also the core techniques for solving numerical problems by computer. The particular problems addressed in this course are the solution of linear and non-linear equations both with and without constraints, fitting functions to data, and the optimisation of functions.

6.2 Learning outcomes

i) Knowledge and Understanding

Having successfully completed this module, the students will be able to:

1. Solve a range of predictable and unpredictable problems in Number Analysis;
2. Have an awareness of the abstract concepts of theoretical mathematics in the field of Numerical Analysis;
3. Have a knowledge and understanding of fundamental theories of these subjects demonstrated through one or more of the following topic areas: Non-linear equations;
4. Polynomial interpolation;
5. Least squares approximation;
6. Numerical differentiation and integration;
7. Matrix equations;
8. Perform polynomial interpolation and understand the associated theory;
9. Derive best approximations in L-infinity for special cases using low degree polynomials;
10. Know the definitions and basic properties of Chebychev polynomials;
11. Obtain best L2-approximations and understand the associated theory;
12. Know the definitions and basic properties of Legendre polynomials;
13. Be able to derive the general form of a Gaussian quadrature formula, perform the associated error analysis, derive formulae of a specific order and apply them to examples.

14. In addition students will have the ability to undertake and defend the use of alternative mathematical skills in the following areas with minimal guidance: Modelling, Computation.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

15. Use special functions in programming to solve problems;
16. Use partial differential equations in programming to solve problems;
17. Use numerical analysis in programming to solve problems;
18. Use complex variables in programming to solve problems.

iii) Communication/ICT/Numeric/Analytic Techniques/Practical Skills

Having successfully completed the module, students will be able to:

19. Appreciate the importance of approximate methods in science and engineering;
20. Understand algorithms and programming;
21. Relate mathematical theory to algorithm;
22. Estimate or bound errors using formulae;
23. Solve partial differential equations;
24. Use numerical analysis in solving programming problems

iv) General transferable skills

25. State the aims of numerical analysis;
26. Explain the notions of absolute and relative error, significant figures and decimal places. Perform a simple calculation to a given number of significant figures;
27. State and use basic methods for polynomial interpolation in one variable. State and use formulae for the error in interpolation;
28. State and use various standard algorithms to approximate a root of an equation in one real variable. Derive formulae for the speed of convergence of some of them;
29. State and use some basic methods (“rules”) for numerical integration in one variable. Distinguish “simple” from “compound” rules. Derive simple rules by method of undetermined coefficients. State and use formulae for the error in some rules.

30. State and use some simple methods for ODE initial value problems: Euler's method, order 2 Taylor method. Explain, with a diagram, the difference between local error and global error;
31. Perform a dry run of simple pseudo-code. Convert pseudo-code to valid Maple code, execute this and check actual with expected output.

7. Indicative Content

The indicative content of Numerical analysis and applications are:

a) Approximation theory: Piecewise polynomial approximation and spline functions;
b) Approximation by rational functions;
c) Trigonometric polynomials and fast Fourier transforms;
d) Numerical solution of ordinary differential equations: Introduction to numerical methods for initial-value problems;
e) Local and global truncation errors, convergence;
f) One-step methods, with emphasis on explicit Runge-Kutta methods;
g) Practical algorithms;
h) Linear multistep methods;
i) Predictor - corrector methods;
j) Shooting methods;
k) Specialist software will be used for computational work throughout the module.

8.**Learning and Teaching Strategy**

The role of the lecturer is to be a facilitator. He must be always at the level of knowing what the student has understood about the subject taught. He must give clarifications so that students are able to go for research of more details. Lecturer has to give more assignment, group work and homework to students. He must try always to give case studies to students to let them digest well the subject and to know how to apply it to real life. Because of the system of students centred learning more Seminars and practical are given to students.

9. **Assessment Strategy**

- Lecturer may ask students to prepare presentations to encourage students to make they own research.

- Lecturer may ask students to make their own research about particular topic using library resources or internet and then produce report. These reports can be assessed formatively to give feedback to students
- Alternatively some of the assessment tools mentioned above can be used by Lecturer to award marks and record them for administrative purposes as summative assessment.
- There will be comprehensive final examination (Paper-Pencil test) to give score to each student and record them for administrative purpose.

10. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
CATs	**60**	**1-4**
Final Assessment Test	**40**	**1-4**
Total	**100**	

11. Strategy for feedback and student support during module

Correction in class of written in-course tests, assignment, exercises and laboratory exercises, discussion in group work for case studies given before to students allow them to mustering the course very well.

12. Indicative Resources

Core texts

Recommended Book Resources

1. Mayers D and Riess R D, *An Introduction to Numerical Analysis,* Cambridge U P (2006) QA 297.S8.
2. Johnson L W and Riess R D, *Numerical Analysis*, Addison Wesley (1982) QA 297.J6
3. Hinton and D.R.J. Owen, (R) An introduction to finite element computations , Pineridge Press, 1979.
4. D.J. Henwood & J. Bonet, (R) Finite Elements - A Gentle Introduction, Macmillan, 1997.
5. J Fish & T Belytschko, A First Course in Finite Elements, John Wiley & Sons, 2007.ISBN: 0470035803.
6. An Introduction to Numerical Analysis, K.E. Atkinson (2nd edition), J Wiley & Sons(1978).

7. R. Dautray and J.L. Lions*, Mathematical analysis and numerical methods for science and technology*, Vol. 2 Springer-Verlag, Berlin,1988.

Other Resources

1. Y. Saad, Numerical solutions of large nonsymetric eigenvalue problems, John Wiley & Sons, New York, 1992.
2. D.C. Sorensen, Implicit application of polynomial filters in a k-step arnoldi method, SIAM J. Matrix Anal. Appl., 13(1): 357-385, 1992.
3. S. D. Conte, Elementary Numerical Analysis: An Algorithmic Approach, McGraw- Hill Book Company, USA, 1980.
4. J. H. Curtiss, Introduction to functions of a complex variable, Marcel Dekker Inc., USA, 1978.
5. A. David Wunsch, Complex Variables with Applications, Pearson Education Inc, USA, 2005.
6. Edward B. Saff & Arthur David Snider, Fundamentals of Complex Analysis with Applications to Engineering, Science, and Mathematics, Prentice Hall, USA, 2002.
7. Friedrich Sauvigny, Partial Differential Equations 1: Foundations and Integral epresentations, Springer, Germany, 2006.
8. Kenneth Lange, Numerical Analysis for Statisticians, Springer-Verlag, New York, 1999.

13. Teaching Team

- **TWAGILIMANA Cyprien Module Leader**
- **NDASHIMYE Emmanuel (Member)**
- **NAHIMANA Godefoid**

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
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Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 2

1. **Module Code:** CSC 402**..... School:** SCIENCE AND TECHNOLOGY
2. **Module Title:** COMPUTER GRAPHICS & VISION

3. Level: 5 Semester: 1 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

This module gives the opportunity to have a meaningful introduction to computer graphics. It also offers a quick, visual, and step-by-step approach for learning fundamental concepts of multimedia. It explains what multimedia is, how it works, and raises broader issues about how the various applications relate to the latest technology and job market.

6.2 Learning Outcomes

i) *Knowledge and Understanding*

Having successfully completed the module, students should be able to demonstrate knowledge and understanding of:

i. The wonder of modern computer graphics and show how the graphics process works.

ii. The mechanisms by which we get computer graphics on the screen.

iii. Multimedia authoring tools and recent developments

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

iv. Pursue the development of graphics techniques and their associated interactive tools right up to the current state of the art.

v. Show for the potential user of graphics how the tools of graphic usage are created and thus how they may be exploited to advantage.

vi. Think visually about problems

vii. Transform the geometry into a suitable image

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

viii. Use a modern graphics API to create a graphics application

ix. Integrate graphics into computer applications effectively

x. Have a more targeted goal such as games or scientific visualization

xi. Create effective communications

xii. Develop multimedia for a Web design firm.

iv) General transferable skills

Having successfully completed the module, students should be able to:

xiii. Look forward to plenty of opportunity because the need for Multimedia and Design professionals is growing as fast as the Internet itself.

xiv. Carry out studies in graphic design and artistic technique

xv. Create a visual representation that is to develop a geometrical representation of the model

9. Indicative Content

Characteristics of display devices: raster, vector, pixel etc. Representation of primitive objects :lines, curves, surfaces. Representation of composite objects. Graphics hardware: Continual refresh and storage displays. Devices resolutions. Display processors. Character generators. Display techniques: Colour-display techniques. Display description. Screen co-ordinates, user co-ordinates. Graphical data structures. Display-code generation. The viewing algorithm. Transformations. Graphics software: three dimensional graphics. Workstation models: bit-mapped, raster operations, postscript. Graphics Standards. Colour and texture: Shading and coloring; Ray tracing; Rendering processes; Animation techniques.

Multimedia - An Overview, Multimedia Elements: Text and Graphics. Understanding Multimedia Elements - Sound, Image and graphics, Animation, Video . Multimedia Authoring Programs. Data compression. Multimedia Operating Systems. Multimedia Communication Systems. Multimedia Applications. User interfaces. Development and Design of Multimedia Titles. Management and Distribution of Multimedia Titles. Documents, Hypertext and MHEG (Multimedia and Hypermedia Information Coding Expert Group). Case Study: Incorporating Multimedia into a Web Site., Interactive multimedia. Streaming, sampling techniques, Image recognition and digitization.

8. Learning and Teaching Strategy

The lecturer will give clarifications so that students be able to go for research of more details. He has to give more assignment, group work and homework to students. He must try always to give case studies to students to let them digest well the subject and to know how to apply it to real life.

9. Assessment Strategy

Formative and summative assessments are organized.

In-course assessment composed of written test, assignment or homework and handled practical assignment must be organized. Students have to receive comments on their works and results where it is needed.

10. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
CATs	**60**	**1-4**
Final exam	**40**	**1-4**
Total	**100**	

11. Strategy for feedback and student support during module

Correction in class or in computer laboratory of written in-course tests, assignment, laboratory exercises, discussion in group work for case studies given early to students etc. Seminars have to be criticized**.** Lecturer will provide feedback to students about the assessment papers.

12. Indicative Resources

Core Text

- Ralf Steinmetz, Klara Nahrstedt , [1995]*, Multimedia Computing, Communications & Applications*, , Prentice Hall,
- Steve Cunningham , [2007], Computer Graphics, Programming, Problem Solving, and Visual Communication, , Printice Hall,

Background Texts

- Alan Watt and Steve Maddock, [2008], *3D Computer Graphics with OpenGL and Direct3D,* Fourth Edition, Addison Wesley,
- Donald Hearn, M. Pauline baker , [1997], *Computer graphics* 2nd Edition,C version, , Prentice Hall,

Teaching/Technical Assistance

- 1 Tutorial Assistant
- 1 Lab attendant

Computer requirements

- Programming language such as the suite of Visual studio, Turbo C++ etc…
- Macro Media Flash, Adobe Creative Suite, Auto CAD, 3DS, MAYA

13. Teaching Team

Dr NDAYAMBAJE Pius, Module leader

NAHIMANA Godefroid

NDASHIMYE Emmanuel

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 3

1. **Module Code:** CSC 403**..... School:** SCIENCE AND TECHNOLOGY
2. **Module Title:** FORMAL LANGUAGE AND AUTOMATA

3. Level: 5 Semester: 1 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

This module lays the foundations in discrete mathematics commonly required in many areas of computer science. It reinforces the concept of mathematical proof, including constructive proof by giving an algorithm.

6.2 Learning outcomes

i) Knowledge and Understanding

Upon successful completion of this module, you should be able to:

1. Explain the basics of automata theory, formal language theory, computability theory, complexity theory and lambda calculus;
2. Explain non-computability and non-decidability issues;

3. Describe and use the connection between automata and languages;
4. Explain and use lambda calculus as a theory of functional programming;
5. Specify formal languages;
6. Translate between various forms of description of formal languages;
7. Have a good understanding of lexical analysis and parsing tools;
8. Understand ideas of decidability and the Church-Turing thesis;
9. Explain the connection between theory and applications;
10. Understanding of the equivalence between machine types and language types;
11. The nature of formal languages and their specification by grammars and other notations;
12. The practical and theoretical relevance of machines that process strings from an alphabet of symbols as models of computation;
13. The fundamental limits on what is computable by any machine;
14. Read and understand definitions and proofs using basic discrete mathematics;
15. Formulate simple definitions and proofs in discrete mathematics;
16. Understand the concepts of formal languages, automata and grammars, and the relation between them;
17. Understand in more detail:
    a. Regular languages and finite automata;
    b. Context-free languages and pushdown automata.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

18. Apply and deploy mathematical ability, practices and tools;
19. Understand complex ideas and relate them to specific problems or questions;
20. Understanding and ability to apply techniques for language specification

iii) Communication/ICT/Numeric/Analytic Techniques/Practical Skills

Having successfully completed the module, students will be able to:

21. Understanding and ability to apply techniques for language specification.

iv) General transferable skills

Having successfully completed the module, students will be able to use mathematics to solve problems.

7. Indicative Content

Propositional logic; logical arguments; predicate logic. Proof methods including calculation, reductio ad absurdum and induction. Set theory. Relations and their properties; representation as pair-sets, directed graphs, boolean matrices. Special classes of relations and their properties: functions, orderings and equivalences; composition, closures. Introduction to formal languages, automata, and grammars. Regular expressions, regular languages, limitations. Deterministic and non-deterministic finite-state machines. Relationship to regular languages and regular grammars. Finite automata with output and their applications. Automata minimization. Decidable problems. Context-free grammars. Pushdown automata and their ability to accept context-free languages. Correspondence between types of grammars and automata: Chomsky's hierarchy.

8. Learning and Teaching Strategy

The role of the lecturer is to be a facilitator. He must be always at the level of knowing what the student has understood about the subject taught. He must give clarifications so that students are able to go for research of more details. Lecturer has to give more assignment, group work and homework to students. He must try always to give case studies to students to let them digest well the subject and to know how to apply it to real life. Because of the system of students centred learning more Seminars and practical are given to students.

9. Assessment Strategy

- Lecturer may ask students to prepare presentations to encourage students to make they own research;
- Lecturer may ask students to make their own research about particular topic using library resources or internet and then produce report. These reports can be assessed formatively to give feedback to students;
- Alternatively some of the assessment tools mentioned above can be used by Lecturer to award marks and record them for administrative purposes as summative assessment;
- There will be comprehensive final examination (Paper-Pencil test) to give score to each student and record them for administrative purpose;

12. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
CATs	**60**	**1-4**
Final exam	**40**	**1-4**
Total	**100**	

11. Strategy for feedback and student support during module

Correction in class or in computer laboratory of written in-course tests, assignment, exercises and laboratory exercises, discussion in group work for case studies given before to students allow them to mustering the course very well.

12. Indicative Resources

Core texts

Recommended Book Resources

1. Dean N, *The Essence of Discrete Mathematics*, Prentice Hall, 1997.
2. Haggarty R., *Discrete Mathematics for Computing*, Addison Wesley, 2002.
3. Truss J., *Discrete Mathematics for Computer Scientists*, Addison Wesley, 1999.
4. Linz P., *An Introduction to Formal Languages and Automata* (4th ed.), Jones and Bartless, 2006
5. Rodger S.H. and Finley T.W., JFLAP: *An Interactive Formal Language and Automata Package*, Jones and Bartless, 2006.
6. Solow D., *How to Read and Do Proofs*, Wiley, 2005.
7. Dexter C. Kozen, *Automata and computability*, Springer, 1997.
8. W. Thomas, *Automata on Infinite Objects, in Handbook of Theoretical computer Science*, Volume B, North-Holland, 1990.
9. W. Thomas, *Languages, Automata and Logic, Technical Report*, Bericht 9607, Institute fun Informatik, University of Kiel, 1996.
10. Dexter Kozen, *Automata and Computability*, Springer, 1997.

11. M. D Davis, R. Sigal and E.J. Weyuker. Computability, Complexity and Languages, Academic Press, 2nd edition, 1994. ISBN: 0122063821.

12. J.E Hopcroft, J.D. Ullman, Formal Languages and their Relation to Automata, Addison-Wesley, 1969.

13. Teaching Team

- **Lecturer TWAGILIMANA Cyprien Module Leader**
- **Lecturer NDASHIMYE Emmanuel (Member)**
- **Lecturer NAHIMANA Godefoid**

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 4

1. **Module Code:** CSC 404**..... School:** SCIENCE AND TECHNOLOGY
2. **Module Title:** INTELLIGENT SYSTEMS

3. Level: 5 Semester: 1 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

This module introduces representations, techniques, and architectures used to build applied systems and to account for intelligence from a computational point of view. It also introduces theory of computation: formal languages and models of computations. This module also explores applications of Natural language, Vision, Robotics, Machine learning. It explores also the characteristics and techniques of decision support systems.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students should be able to demonstrate knowledge and understanding of:

i. The mathematical treatment of language in a computational machine.

ii. Algebraic expressions as a formal representation of computational machines used as language processors.

iii. The domain of Business, Management and Organizational aspects of Information Technology (IT).

iv. The basic architecture of decision support and expert systems and provide frameworks for the analysis and design of such systems.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

v. Develop small logic-based, rule-based and search-based systems, predict performance characteristics, and describe the role of search in intelligent system engineering.

vi. Conduct research in any area of the artificial intelligence applications

vii. Use Artificial intelligence concepts in real life problem solving.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

viii. Teach theory of computation, the concept of artificial Intelligence and decision support system and expert system.

ix. Apply elementary skills in the use of a decision support system.

x. Apply gained knowledge to design an intelligent system and a decision support system to be used in management domain.

iv) General transferable skills

Having successfully completed the module, students should be able to:

xi. Work in industry of management software development.

xii. Understand and design a solution of a decision support system.

xiii. Analyze, design and implement artificial intelligent software.

7. Indicative Content

Finite automata, pushdown automata, and linear-bounded automata. Turing machines (deterministic and nondeterministic). Formal languages. Regular, context-free, context-sensitive, and unrestricted grammars. Equivalence of grammars with corresponding automata. Models of computation: Turing machines, random-access machines, lambda calculus, and recursive functions. Computability, formal definitions, and Church's thesis. Effectively enumerable and undecidable problems.

Techniques of artificial intelligence. Knowledge Representation. Problem solving: state space search heuristic, pattern recognition, classification, inference, grammars, knowledge elicitation, knowledge engineering. Artificial intelligence applications: Natural language, Vision, Robotics, Expert Systems, Machine learning. Artificial intelligence tools: Introduction to Prolog, LISP. Shell programming. Construction of a small expert system using an expert system shell and an AI language such as LISP or PROLOG.

Decision Support Systems: Introduction: Managerial decision making and its implications for information technology. Definitions of a DSS and its place in the development history of business systems. Architecture of a DSS: database and database management system, model base and model based management systems. Analysis and Design of DSSs: Three different levels of technology - iterative design, adaptive and evolutionary systems. Dynamic programming. The principle of optimality. Decision trees. Critical path planning. DSS Generator (Software Aids): Introduction to GPSS programming language GPSS-PS, the construction of simulation models in the GPSS code, the interpretation of the GPSS report writer output. Examples of specific DSSs.

8. Learning and Teaching Strategy

The lecturer will give clarifications so that students are able to go for research of more details. He has to give more assignments, group works and homeworks to students. He will try always to give case studies to students to let them digest well the subject and to know how to apply it to real life.

9. **Assessment Strategy**

Formative and summative assessments are organized.

In-course assessment composed of written test, assignment or homework and handled practical assignment must be organized. Students will receive comments on their works and results where it is needed.

10. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
CATs	**60**	**1-4**
Final exam	**40**	**1-4**
Total	**100**	

11. Strategy for feedback and student support during module

Correction in class or in computer laboratory of written in-course tests, assignment, laboratory exercises, discussion in group work for case studies given to students etc. Lecturer will provide feedback to students about the assessment papers.

12. Indicative Resources

Core Text

- Ralph M. Stair, [1992], *Principles of Information Systems, a managerial approach*, boyd &fraser publishing company,
- Robert McNaughton, [1982], *Elementary Computability, Formal Languages, and Automata*, Prentice Hall,

Background Texts

- Dan W. Patterson, [2003], *Introduction to artificial Intelligence and Expert systems*, University of Texas, El Paso, Prentice Hall of India, Artificial Intelligence, MIT OpenCourseWare of Open University Material, Spring 2005
- Peter Jackson, [1999], *Introduction to Expert Systems, Third Edition* , Addison Wesley, ISBN 978-0-201-87686-4
- Stuart Russel, PeterNorvig, [2003], *Artificial Intelligence A modern Approach: International edition, second edition*, Prentice Hall, 978-0-13-080302-3.

Teaching/Technical Assistance

- 1 Lab Attendant
- 1 Tutorial Assistant

Computer requirements

- Database management systems such us SQL 2000 Server, Oracle and MySQL
- Programming language such as the suite of Visual studio, PHP, Turbo C++ etc…

13. Teaching Team

Dr. NDAYAMBAJE Pius

Mr Kagarama John Baptist

Mr Niyikiza Gaston

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	

Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 5

1. Module Code: CSC 405**..... School:** SCIENCE AND TECHNOLOGY

2. Module Title: SOFTWARE ENGINEERING

3. Level: 5 Semester: 1 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

This module includes both theoretical and practical aspects of Software Engineering.

Module consists of two units

Unit 1: Introduction to Software Engineering

Unit 2: Software Project Management

Unit1: This unit will provide the foundation of systems analysis and design by covering requirements analysis and design for both commercial and technical applications. It will also introduce the data and functional modeling techniques, which students can be expected to use. Student will learn the software processes life cycle models such as prototype, evolutionary and spiral models. Students will understand basic concepts of coding and testing.

Unit2: Students will gain an understanding of the ways in which projects can be handled and be able to estimate time and cost and the risk associated with a project.

6.2 LEARNING OUTCOMES

i) Knowledge and Understanding

Having successfully completed the module, students should be able to demonstrate knowledge and understanding of:

1. Techniques for the estimation, design, building, and quality assurance of software projects. It covers fundamentals of software engineering, covering (almost) the entire software life cycle from early project planning through to verification of the finished product.
2. Conceptual background for undertaking advanced studies in software engineering.
3. Identify the characteristics of “good software”.
4. To introduce ethical and professional issues that are useful to software engineers
5. Define what is meant by the term “process” and how it applies to software development.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

6. Describe several different models of the software development process and understand their drawbacks and when they are applicable.
7. To introduce architectural design and to discuss its importance

8. To explain the architectural design decisions.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

9. To introduce the concepts of software requirements
10. To describe user, system and specification requirements
11. To understand the concepts of software design

iv) General transferable skills

Having successfully completed the module, students should be able to:

12. Compare and contrast object-oriented analysis and design (UML) with structured analysis and design using concrete case studies.
13. To discuss coding and testing
14. To understand process planning, working knowledge of techniques for the estimation (Time, cost), risk management, configuration management and quality assurance of software projects.

7. Indicative content

Unit 1: Introduction to Software engineering

Software Engineering concepts, CASE, Software quality attributes, Software Crisis.

SOFTWARE PROCESS: Process and Project, Component Software Processes, Software Development Process Model; Waterfall Model, Prototyping Model, Iterative Development Model, RUP Model, Timeboxing Model, Extreme Programming.

SOFTWARE REQUIREMENTS ANALYSIS AND SPECIFICATION: Function and Goals of requirements, Types of requirement, Software specification document,

Object - Oriented analysis (UML) and structured system analysis.

SOFTWARE ARCHITECTURE: Role of Software Architecture, Architecture Views,

SOFTWARE DESIGN: Software Design Concepts, Modularity; cohesion, coupling and open-closed.

CODING AND UNIT TESTING: Programming Principles, unit testing Concepts. TESTING AND MAINTENANCE Testing Concepts, Testing types.

Unit 2: Software Project Management

Introduction to project, Software projects versus other projects, activities covered by software project management, selection of appropriate project approach, choosing technologies, waterfall model, spiral model, software prototyping, v-process model, incremental approach, selecting the most appropriate process model, project evaluation, cost benefit analysis, project management, project effort and scheduling estimation, network analysis, critical path analysis using arrow diagrams, risk management, configuration management, project monitoring and control, project cost management.

8. Learning and teaching strategy

Theory: Formal lectures will be presented to cover the material of the course, with tutorials.

*Practical: E*xamples of projects that used different software engineering techniques, seminar practices will be given to workout individually/groups.

Self-study: Students are also expected to undertake at least 50 hours private study including preparation of worked solutions for tutorial classes.

9. Assessment strategy

Assessment criteria

- Knowledge and critical understanding of theory.
- Ability to solve relevant problems.
- Ability to write and deliver presentations in appropriate language.
- Ability to perform laboratory experiments, interpret results and write reports.

- Problem solving skills.

All assessment methods try to force the learner to demonstrate his / her ability to think through unseen problems.

10 assessment pattern

Component	Weighting (%)	Learning objectives covered
CATs	**60**	**1-4**
Final Assessment Test	**40**	**1-4**
Total	**100**	

11. Strategy for feedback and student support during module

- Consultation hours to see the students in the office.
- Two meeting with the students during the semester to discuss their problems (if any).
- Analyzing the results of the tests and seminars to reach possible problems and take measures to solve them.

12. Indicative resources

Core Text (include number in library or URL) (inc ISBN)

Grady Booch, et al. (2007), Object-Oriented Analysis and Design with Applications, third edition. Benjamin/Cummings.

Roger S. Pressman, Software Engineering: A Practitioner's Approach, Sixth Edition, McGraw-Hill

Ian Sommerville (2007), Software Engineering , 8th Edition, Addison Wesley.

13. Teaching Team

Dr NDAYAMBAJE Pius

Mr KAGARAMA John Baptist

Mr NIYIKIZA Gaston

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 6

1. Module Code: CSC 406**..... School:** SCIENCE AND TECHNOLOGY

2. Module Title: ENTREPRENEURSHIP

3. Level: 5 Semester: 1 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

Upon completion of this module the students will be to prepare a business plan of some of the projects related to IT specialization which can be started in Rwanda.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module; students should be able to demonstrate knowledge and understanding of:

i. Entrepreneurial mindset.
ii. Entrepreneurial characteristics.
iii. Entrepreneurial myth.
iv. Theories of entrepreneurship, Identification.
v. Selection and business plan writing.

vi. Building the management team.
vii. Legal Aspects.
viii. Analyzing the market.
ix. Pricing of products and services.
x. Marketing/Penetration tactics.
xi. Financial statements, ratios.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should develop the following cognitive skills:

xii. Budgeting and Cash flow projections.
xiii. Operation and managing growth of an enterprises.
xiv. Sources of finance.
xv. The entrepreneur and the community.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be:

xvi. Equipped with the entrepreneurship and business skills.

xvii. Be exposed to the business environment and challenge them

xviii. Be able to come up with business mindset

xix. To create their own job in the future.

xx. To come up with a bankable business plans.

iv) General transferable skills

Having successfully completed the module, students should be able to Share skills in those studied courses.

7. Indicative Content

Introduction to entrepreneurial mindset, Entrepreneurial characteristics, Entrepreneurial myth, Theories of entrepreneurship, Identification, selection and business plan writing, Building the management team, Legal Aspects, Analyzing the market, Pricing of products and services, Marketing/Penetration tactics, Financial statements, ratios, budgeting and Cash flow projections, Operation and managing growth of an enterprises, Sources of finance, The entrepreneur and the community.

8. Learning and Teaching Strategy

- Teacher introduces available Computer hardware in the lab and demonstrates practically disassembling and assembling the computer system.

- Seminar/workshop, quiz, debate competitions will be organized and students will be encouraged to participate subject to resource availability.
- Students will discuss the concepts in peer groups during informal conversation and share knowledge.

9. **Assessment Strategy**

- Students may be asked to work on short-term Business plan projects in which students plan and physically implement a business plan on his or her capability.
- Teacher may ask students to make their own research about particular topic using library resources or internet and then produce computerized report. These reports can be assessed formatively or can be awarded as continuous assessment.
- There will be comprehensive final examination to give score to each student and record them for administrative purpose.

10. Assessment Pattern

Component	**Weighting (%)**	**Learning objectives covered**
CATs	**60**	**1-4**
Final Assessment Test	**40**	**1-4**
Total	**100**	

11. Strategy for feedback and student support during module

Students will be given feedback for formative assessments to tell them how they are progressing in terms of knowledge, skills and understanding of a subject. Feedback will be given to the students either during or after the assessment.

12. Indicative Resources

Core Text

- Dieter, G. business development service entrepreneurship training module for SMEs, BDS forum, Heidelberg Germany.
- Kirby, A.D. (2003), Entrepreneurship. McGraw-Hill, Berkshire, UK.
- Carter, S. and Jones-Evans, D.(2007), Enterprise and small business: principles, practice and policy, pretince Hall financial times, Great Britain.

- Ronstald, C.R (2008) Ed. Entrepreneurship: Text, Cases and Notes, Lord Publishing, Dover.
- Gupta, C. B and Srinivasan, N.P.(1992),Entrepreneurial Development,1st Ed, Sultan chand and son, New Delhi.

Key websites and on-line resources

https://www.concern.net/where-we-work/africa/rwanda

http://isoko-institute.org/uncategorized/entrepreneurs-of-rwanda/

Teaching/Technical Assistance

Lecturer will be required for teaching on Presentations Techniques as well as on Performance Analysis and Assignments.

Laboratory space and equipment

Internet connection for students' research and self study.

13. Teaching Team

Mr. YAHYA HASSANI

Mr. KAGARAMA JOHN BAPTIST

Mr. NAHIMANA GODEFROID

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 7

1. Module Code: CSC 407**..... School:** SCIENCE AND TECHNOLOGY

2. Module Title: OPERATIONAL RESEARCH

3. Level: 5 Semester: 2 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

This course provides an essential study of computational techniques used by large organizations (such as the military, big business, and major universities) to most efficiently manage resources, maximize profits and/or minimize costs.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students should be able to demonstrate knowledge and understanding of:

xiv. The mathematical treatment of language in a computational machine.

xv. Algebraic expressions as a formal representation of computational machines used as language processors.

xvi. The domain of Business, Management and Organizational aspects of Information Technology (IT).

xvii. The basic architecture of decision support and expert systems and provide frameworks for the analysis and design of such systems.

v) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

xviii. Develop small logic-based, rule-based and search-based systems, predict performance characteristics, and describe the role of search in intelligent system engineering.

xix. Conduct research in any area of the artificial intelligence applications

xx. Use Artificial intelligence concepts in real life problem solving.

vi) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

xxi. Teach theory of computation, the concept of artificial Intelligence and decision support system and expert system.

xxii. Apply elementary skills in the use of a decision support system.

xxiii. Apply gained knowledge to design an intelligent system and a decision support system to be used in management domain.

vii) General transferable skills

Having successfully completed the module, students should be able to:

xxiv. Work in industry of management software development.

xxv. Understand and design a solution of a decision support system.

xxvi. Analyze, design and implement artificial intelligent software.

7. Indicative Content

Finite automata, pushdown automata, and linear-bounded automata. Turing machines (deterministic and nondeterministic). Formal languages. Regular, context-free, context-sensitive, and unrestricted grammars. Equivalence of grammars with corresponding automata. Models of computation: Turing machines, random-access machines, lambda calculus, and recursive functions. Computability, formal definitions, and Church's thesis. Effectively enumerable and undecidable problems.

Techniques of artificial intelligence. Knowledge Representation. Problem solving: state space search heuristic, pattern recognition, classification, inference, grammars, knowledge elicitation, knowledge engineering. Artificial intelligence applications: Natural language, Vision, Robotics, Expert Systems, Machine learning. Artificial intelligence tools: Introduction to Prolog, LISP. Shell programming. Construction of a small expert system using an expert system shell and an AI language such as LISP or PROLOG.

Decision Support Systems: Introduction: Managerial decision making and its implications for information technology. Definitions of a DSS and its place in the development history of business systems. Architecture of a DSS: database and database management system, model base and model based management systems. Analysis and Design of DSSs: Three different levels of technology - iterative design, adaptive and evolutionary systems. Dynamic programming. The principle of optimality. Decision trees. Critical path planning. DSS Generator (Software Aids): Introduction to GPSS programming language GPSS-PS, the construction of simulation models in the GPSS code, the interpretation of the GPSS report writer output. Examples of specific DSSs.

10. Learning and Teaching Strategy

The lecturer will give clarifications so that students are able to go for research of more details. He has to give more assignments, group works and homeworks to students. He will try always to give case studies to students to let them digest well the subject and to know how to apply it to real life.

11. **Assessment Strategy**

Formative and summative assessments are organized.

In-course assessment composed of written test, assignment or homework and handled practical assignment must be organized. Students will receive comments on their works and results where it is needed.

10. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
CATs	**60**	**1-4**
Final Assessment Test	**40**	**1-4**
Total	**100**	

11. Strategy for feedback and student support during module

Correction in class or in computer laboratory of written in-course tests, assignment, laboratory exercises, discussion in group work for case studies given to students etc. Lecturer will provide feedback to students about the assessment papers.

12. Indicative Resources

Core Text

- Ralph M. Stair, [1992], *Principles of Information Systems, a managerial approach*, boyd &fraser publishing company,
- Robert McNaughton, [1982], *Elementary Computability, Formal Languages, and Automata*, Prentice Hall,

Background Texts

- Dan W. Patterson, [2003], *Introduction to artificial Intelligence and Expert systems*, University of Texas, El Paso, Prentice Hall of India, Artificial Intelligence, MIT OpenCourseWare of Open University Material, Spring 2005
- Peter Jackson, [1999], *Introduction to Expert Systems, Third Edition* , Addison Wesley, ISBN 978-0-201-87686-4
- Stuart Russel, PeterNorvig, [2003], *Artificial Intelligence A modern Approach: International edition, second edition*, Prentice Hall, 978-0-13-080302-3.

Teaching/Technical Assistance

- 1 Lab Attendant
- 1 Tutorial Assistant

Computer requirements

- Database management systems such us SQL 2000 Server, Oracle and MySQL
- Programming language such as the suite of Visual studio, PHP, Turbo C++ etc…

13. Teaching Team

Dr. NDAYAMBAJE Pius

Mr Kagarama John Baptist

Mr Niyikiza Gaston

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 9

1. Module Code: CSC 409**..... School:** SCIENCE AND TECHNOLOGY

2. Module Title: DISTRIBUTED COMPUTING SYSTEM

3. Level: 5 Semester: 2 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

This module introduces the student to the variety of techniques required for the design of parallel algorithms. It also provides undergraduate students in computer science with experience of parallel and distributed computing. It gives an overview of parallel and distributed computers, and parallel computation. The course addresses architectures, languages, environments, communications, and parallel programming.Emphasis on understanding parallel and distributed computers and portable parallel programming with MPI.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students should be able to demonstrate knowledge and understanding of:

i. Concepts involved in the design, structure, and use of systems having interacting processors.

ii. Knowledge of advanced concepts, paradigms and models for building distributed systems

iii. Consolidation of concepts from most of the subject areas of the discipline of computing i.e. Algorithms and Data Structures, Programming Languages, Computer Architecture, Operating Systems, and Software Engineering that are important for the basic support of parallel and distributed systems.

iv. The use of concepts from Numerical and Symbolic Computation, Database Systems, Artificial Intelligence, and Human Computer Communications which are important in many in distributed systems applications.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should be able to:

v. Learn basic principles of parallel and distributed computing and with parallel and distributed algorithms

vi. Describe the various paradigms and architectures of parallel and distributed systems

vii. Describe the different parallelization techniques

viii. Describe how to manage load in a parallel system

ix. Analyze a given application/problem and implement a parallelization strategy

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

x. Write MPI programs and implement them on a cluster computer be able to develop models of evaluation of modern distributed systems

iv) General transferable skills

Having successfully completed the module, students should be able to:

xi. Make the discussion of current research results on theoretical studies motivated by the problems of building distributed systems.

xii. Understanding and operating with parallel and distributed systems topics involving concepts, architectures and programming models.

xiii. Work in group with his colleagues by respecting time management.

7. Indicative Content

Concurrency and synchronization; architectural support; programming language constructs for parallel computing; parallel algorithms and complexity; messages vs. remote procedure calls vs. shared memory models; structural alternatives (e.g., master-slave, client-server, fully distributed, cooperating objects); coupling (tight vs. loose); naming and binding; verification, validation, and maintenance issues; fault tolerance and reliability; replication and avoidability; security; standards and protocols, temporal concerns (persistence, serializability); data coherence; load balancing and scheduling; appropriate applications.

LAB: Distributed and Parallel Programming Constructs

Develop one or more parallel programs in a programming language that supports parallelism (e.g., Ada, Concurrent Pascal, Occam, Parlog). Student gains familiarity with parallelism and its use at this language level.

Introduction to the development of algorithms for parallel and distributed architectures, illustrating how parallelism can yield significant speed-up in comparison with sequential execution. Examples can be taken from areas such as parallel MAX, MIN, AND, and OR, as well as parallel adders. Algorithms, lower and upper bounds algorithms, and impossibility results. Models for parallel architectures and sample parallel algorithms (emphasis will be placed on realistic models of computation and realistic fault assumptions). Distributed and Parallel Programming Constructs: Description of alternative realizations of asynchronous and parallel constructs in programming languages. Addition of parallel constructs (e.g. tasks, monitors, parallel loops, co-routines) to procedural programming languages. Problems involving scheduling and contention for resources. Promise of functional, logic, object-oriented or other special-purpose languages on highly parallel or distributed architectures.

8. Learning and Teaching Strategy

The lecturer will give clarifications so that students will be able to go for research of more details. He/she has to give more assignment, group work and homework to students. He/she must try always to give case studies to students to let them digest well the subject and to know how to apply it to real life.

9. Assessment Strategy

Formative assessment: is organized in form of in-course written test, assignment or, homework and handled practical assignment. Students have to receive comments on their works and results where it is needed. **Summative** assessment is organized at the end of the module during the exam period

10. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
CATs	**60**	**1-4**
Final Assessment Test	**40**	**1-4**
Total	**100**	

11. Strategy for feedback and student support during module

Correction in class or in computer laboratory of written in-course tests, assignment, laboratory exercises, discussion in group work for case studies given early to students etc.

12. Indicative Resources

Core Text

- George Coulouris, Jean Dollimore and Tim Kindberg, [2005], *Distributed Systems*: *Concepts and Design ,*. Addison-Wesley. Fourth edition. ISBN # 0321263545.
- Maarten Van steen, Andrew S. Tanenbaum, [2007], *Distributed Systems, Principles and Paradigms* second edition, Prentice Hall, ISBN 978-0-13-239227-3
- Wilkinson B. and Allen M., [2005], *Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers*, 2/e, Prentice Hall

Background Texts

- Gary nutt, [2004], *Operating Systems*, International Edition, Third Edition, Addison Wesley, ISBN 978-0-321-18955-4
- Stevens W.R. and Rago S.A., [2005], *Advanced Programming in the Unix Environment*, 2nd Edition, Addison Wesley
- Tanenbaum A.S., Steen M. van, [2002], "*Distributed Systems, Principles and Paradigms*", Prentice Hall.

Teaching/Technical Assistance

- **One Tutorial Assistant**
- **One Lab attendant**

Computer requirements

- Database management systems such us SQL 2000 Server and Oracle
- Programming language such as the suite of Microsoft Visual studio, Turbo C++ etc…
- Operating system Windows Server, Linux, Unix, Simulator.

13. Teaching Team

Dr. NDAYAMBAJE Pius

Mr. NAHIMANA Godefroid

Mr. NDASHIMYE Emmanuel

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

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4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
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Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 10

1. **Module Code:** CSC 410**..... School:** SCIENCE AND TECHNOLOGY
2. **Module Title:** DATA MINING AND DATA WAREHOUSING

3. Level: 5 Semester: 2 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

On successful completion of the course the students should have Learnt the purpose for developing a data warehouse, including difference between operational and decision support system, to describe the architecture of a data warehouse, to Understand project planning aspects of building a data warehouse, Understood and will be able to describe the purpose of data mining and to Understood the knowledge discovery process.

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module; students should be able to demonstrate knowledge and understanding of:

i. Data Mining such as introduction to Data Warehouses,
ii. Transactional Data Mining
iii. Functionalities and Major Issues In Data Mining.
iv. Data Processing such as Data Cleaning, Data Integration and Transformation, Data Reduction, Data Mining Primitives, Languages and System Architecture.
v. Mining Association Rules in Large Databases
vi. Cluster Analysis
vii. Foundation of DATA Warehousing.
viii. Client/Server Computing model & Data Warehousing.
ix. Parallel processors & Cluster Systems.
x. Distributed DBMS implementations.
xi. Client/Server RDBMS Solutions.
xii. Data Warehousing Components.
xiii. Building a Data Warehouse.
xiv. On line Analytical Processing (OLAP).
xv. Patterns & Models Statistics.
xvi. Artificial Intelligence.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should develop the following cognitive skills:

xvii. To explain Data Mining Functionalities, Classification of Data Mining Systems, Major Issues In Data Mining.
xviii. Data Integration and transformation.
xix. Data Generalization & Summarization.
xx. Classification & Prediction and their issues.
xxi. Partitioning methods.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

xxii. Deal with database normalization,
xxiii. Demonstrate competence in utilization of the design of data warehouse and application of data mining techniques to address specific business problems.

iv) General transferable skills

Having successfully completed the module, students should be able to Share skills in the above studied course such as the concepts and techniques of data mining and data warehousing, including concept, principle, architecture, design, implementation, application of data warehousing and data mining. Some systems for data warehousing and/or data mining will also be introduced.

7. Indicative Content

UNIT I: DATA MINING

CONTENTS

Data Mining: Introduction, Relational Databases, Data Warehouses, Transactional databases, Advanced database Systems and Application, Data Mining Functionalities, Classification of Data Mining Systems, Major Issues In Data Mining.

Data Processing: Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and concept Hierarchy Generation.
Data Mining Primitives, Languages and System Architecture: Data Mining Primities, DMQL, Architectures of Data Mining Systems.

Concept Description: Data Generalization & Summarization – Based Characterization, Analytical Characterization, Mining class Comparisons, Mining Descriptive Statistical Measures in Large Databases

Mining Association Rules in Large Databases: Association Rule Mining, Single – Dimensional Booloan Association Rules, Multilevel Association Rules from Transaction Databases, Multi Dimensional Association Rules from Relational Databases, From Association Mining to Correction Analysis, Constraint – Based Association Mining.

Classification and Prediction: Classification & Prediction, Issues Regarding Classification & Prediction, Classification by decision tree Induction, Bayesian Classification, Classification by Back propagation, Classification based on concepts & Association Rule, Other Classification, Prediction, Classification Accuracy.

Cluster Analysis: Types of Data in Cluster Analysis, Partitioning methods, Hierarchical methods, Density – Based Methods, Grid – Based Methods, Model – Based Clustering Methods, Outlier Analysis.
Mining Complex Types of Data.

UNIT II: DATA WAREHOUSING

Foundation: Introduction to DATA Warehousing. Client/Server Computing model & Data Warehousing. Parallel processors & Cluster Systems. Distributed DBMS implementations. Client/Server RDBMS Solutions.

Data Warehousing: Data Warehousing Components. Building a Data Warehouse. Mapping the Data Warehousing to a Multiprocessor Architecture. DBMS Schemas for Decision Support. Data Extraction, cleanup & Transformation Tools. Metadata.

Business Analysis: Reporting & Query Tools & Applications. On line Analytical Processing (OLAP). Patterns & Models. Statistics. Artificial Intelligence.

8. Learning and Teaching Strategy

- Teacher introduces available resources and demonstrates practically data mining and warehousing.
- Seminar/workshop, quiz, debate competitions will be organized and students will be encouraged to participate subject to resource availability.

- Students will discuss the concepts in peer groups during informal conversation and share knowledge.

9. Assessment Strategy

- Students may be asked to work on short-term Data mining or/and data warehousing projects in which students plan and physically implement a computer system on his capability.
- Teacher may ask students to make their own research about particular topic using library resources or internet and then produce computerized report. These reports can be assessed formatively or can be awarded as continuous assessment.
- There will be comprehensive final examination to give score to each student and record them for administrative purpose.

10. Assessment Pattern

Component	**Weighting (%)**	**Learning objectives covered**
CATs	**60**	**1-4**
Final Assessment Test	**40**	**1-4**
Total	**100**	

11. Strategy for feedback and student support during module

Students will be given feedback for formative assessments to tell them how they are progressing in terms of knowledge, skills and understanding of a subject. Feedback will be given to the students either during or after the assessment.

12. Indicative Resources

Core Text

- Jiawei Han, Micheline Kamber, *Data Mining – Concepts and Techniques*, Morgan Kaufmann Publishers, First Edition, 2003. ISBN: 81-8147-049-4.

Reference Book:

- Michael J A Berry, Gordon S Linoff, *Data Mining Techniques*, Wiley Publishing inc, Second Edition, 2004. ISBN: 81-265-0517-6.
- Alex Berson, Stephen J.Smith, *Data warehousing , data mining & OLAP*, , Tata McGraw Hill Publications,2004
- Sushmita Mitra, Tinku Acharya, *Data mining – Multimedia, Soft computing and Bioinformatics*, John Wiley & Sons,2003.

- Sam Anohory, Dennis Murray, *Data Warehousing in the Real World*, Addison Wesley, First Edition, 2000. ISBN: 981-235-967-2.

- W H Inmon, *Building the daata warehouse*, Wiley Computer Publishing, Third edition, 2002. ISBN: 0-471-08130-2.

- George M.Maraks. Modern Data Warehousing, Mining, and Visualization. Core Concepts. Kelley School of Business/Indiana University, 2005

- Michael J.Corey and Michael Abbey. Oracle Data Warehousing. Tata McGraw-Hill Edition, 1997

- Jiawei , H. and Micheline , K.(2006. Intelligent Database Systems Research Lab. School of Computing Science. Simon Fraser University, Canada (Online at http://www.cs.sfu.ca)

- Jiawei, H. and Micheline K. (2006). Data Mining: Concepts and Techniques. [PowerPoint slides].Presented at a lecture at the Univesity of Illinois at Urbana-Champaign.

- Surajit, C. (Microsoft Research, Redmond) and Umeshwar, D (Hewlett-Packard Labs, Palo Alto. An Overview of Data Warehousing and OLAP Technology. Appears in ACM Sigmod Record, March 1997

- Dr. Bernard, C. (2009,Fall). Data Warehouse. [PowerPoint slides].Presented at a lecture at the Univesity of Central Arkansas

- S. Sudarshan and Krithi, R. Data Warehousing and Data Mining. [PowerPoint slides].Presented at a lecture IIT Bombay

- Prof. Anita,W. Data Mining Techniques. Mining Association Rules in Large Databases. . [PowerPoint slides]. Presented at a lecture at State University of New York, Stony Brook

- Dr. Bernard, C. (2010, Fall). Classification and Prediction. [PowerPoint slides]. Presented at a lecture at the Univesity of Central Arkansas

- Dr. Bernard, C. (2011, Spring). Cluster Analysis. [PowerPoint slides].Presented at a lecture at the Univesity of Central Arkansas

Key websites and on-line resources

http://www.dbms2.com/2009/04/30/ebays-two-enormous-data-*warehouses*

Teaching/Technical Assistance

Lecturer will be required for Computer Practices on Presentations Techniques as well as on Performance Analysis and Assignments.

Laboratory space and equipment

Internet connection will be required for student's research.

13. Teaching Team

Mr. KAGARAMA JOHN BAPTIST, Module Leader

Mr. NAHIMANA GODEFROID

Mr. NDASHIMYE EMMANUEL

14. UNIT APPROVAL

Deans and Heads of all Departments contributing to the programme to confirm agreement.

Department	Dean/Head of Department	Date
1	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
2	Signature KAGARAMA John Baptist, Head of Department	
3	Signature Dr OKOKO OSAMBO, Deputy Vice-Chancellor Academics, Kigali Campus	
4	Signature Dr SEKIBIBI Ezechiel, Vice Chancellor	

Seen and agreed

Library	Signature NIYONSABA Cécile, Director, Library, Kigali Campus	
ICT	Signature Dr NDAYAMBAJE Pius, Dean, School of Science & Technology	
Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

MODULE 11

1. Module Code: CSC 411**..... School:** SCIENCE AND TECHNOLOGY

2. Module Title: WIRELESS NETWORKS AND MOBILE COMPUTING

3. Level: 5 Semester: 2 Credits: 10

4. First year of presentation: 2008 Administering School: SCIENCE AND TECHNOLOGY

5. Pre-requisite or co-requisite modules, excluded combinations

6. Allocation of study and teaching hours

Total student hours: 100	**Student Hours**	**Lecture Hours**
Lectures	**40**	**60**
Seminars/workshops		
Practical classes/laboratory	**15**	**15**
Structured exercises	**10**	**10**
Set reading etc.	**10**	
Self-directed study	**10**	
Assignments – preparation and writing	**5**	**5**
Examination – revision and attendance	**10**	**10**
Other: (Invigilation & Marking)		
TOTAL	**100**	**100**

6.1 Brief description of aims and content

This course includes two sub modules that are, “#1.Wireless Networks” “#2. Wireless and mobile computing”

6.2 Learning Outcomes

i) Knowledge and Understanding

Having successfully completed the module, students should be able to:

1. Explain the concepts of distributed operating systems, network operating systems, and other network communication systems.
2. Describe the application layer protocols, distributed processes, distributed synchronization, and distributed object based systems.

ii) Cognitive/Intellectual skills/Application of Knowledge

Having successfully completed the module, students should develop the following cognitive skills:

3. Describe the main characteristics of mobile IP and explain how differs from IP with regard to mobility management and location management as well as performance.
4. Illustrate (with home agents and foreign agents) how e-mail and other traffic is routed using mobile IP.

iii) Communication/ICT/Numeracy/Analytic Techniques/Practical Skills

Having successfully completed the module, students should be able to:

5. Implement a simple application that relies on mobile and wireless data communications.

iv) General transferable skills

6. Describe areas of current and emerging interest in wireless and mobile computing, and assess the current capabilities, limitations, and near-term potential of each.

7. Indicative Content

UNIT I: WIRELESS COMPUTING

CONTENTS

Wireless Computing Fundamentals: History of wireless communication, and future trends, Wireless Generations and Standards, Cellular Concept and Cellular System Fundamentals, Trunking Cell Splitting and Sectoring, Mobile Radio signal propagation, path loss and channel models, Large Scale Path Loss, Small Scale Path Loss: Rayleigh and Rician Fading, Analog Modulation Schemes for Wireless Communication: AM/FM, Digital Modulation Techniques for Wireless Communication, Multiplexing and Multiple Access techniques

Wireless LAN: Wireless LAN, IEEE 802.11, Architecture, services, MAC, Physical layer, IEEE 802.11a, 802.11b standards, HIPERLAN, Blue Tooth, OFDM principles,

Comparison of OFDM and CDMA.

UNIT II: MOBILE COMPUTING

CONTENTS

Mobile Computing (MC): Introduction to MC, novel applications, limitations, and architecture GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security,

andNewdataservices.

Medium Access Control (MAC): Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA,CDMA.

Mobile Network Layer: Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP).

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

Database Issues: Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues.

Data Dissemination: Communications asymmetry, classification of new data delivery mechanisms, push-based mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques.

Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, securityinMANETs.

Protocols and Tools: Wireless Application Protocol-WAP, developing mobile application using WAP. (Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management) and J2ME.

8. Learning and Teaching Strategy

Theory: Formal lectures will be presented to cover the material of the course, with tutorials.

Practical: Practical exercises, examples and seminar practices will be given to workout individually/groups.110100100010

Self-study: Students are also expected to undertake at least 100 hours private study including preparation of worked solutions for tutorial classes.

9. Assessment Strategy

Assessment criteria

- Knowledge and critical understanding of theory.
- Ability to solve relevant problems.
- Ability to write and deliver presentations in appropriate language.
- Ability to perform laboratory experiments, interpret results and write reports.
- Problem solving skills.

All assessment methods try to force the learner to demonstrate his / her ability to think through unseen problems.

10. Assessment Pattern

Component	Weighting (%)	Learning objectives covered
CATs	**60**	**1-4**
Final Assessment Test	**40**	**1-4**
Total	**100**	

11. Strategy for feedback and student support during module

- Consultation hours to see the students in the office.
- Two meeting with the students during the semester to discuss their problems (if any).

Analyzing the results of the tests and seminars to reach possible problems and take measures to solve them.

12. Indicative Resources

1 Vijay K. Garg (2007) *Wireless Communications & Networking* ISBN: 978-0-12-373580-5

2 Asoke K Talukder, Roopa Yavagal (2006) *Mobile Computing*

13. Teaching Team

Mr. KAGARAMA JOHN BAPTIST, Module Leader

Mr. TWAGILIMANA CYPRIEN

Mr. NDASHIMYE EMMANUEL

14. UNIT APPROVAL

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Seen and agreed

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Quality Office	Signature	
	Lecturer RUKUNDO Friend, Director, Quality Assurance	

COMPUTER SCIENCE PROPOSED PROGRAMME INDICATIVE RESOURCES

S.N	Book ID	ISBN	Author	Publisher	Book Title	Date	Subject
1	27784	9780240521893	Andrews	Elsevier Press	Adobe Photoshop Elements for Photographers	2009	Computer Science
2	27723	9780240521152	Caplin	"	How to cheat in Photoshop CS4	2008	Computer Science
3	27498	9780123735966	Celko	"	Joe'sCelko's SQL Puzzles and Answers [Paperback]	2006	"
4	25018	9780240809120	Cusson	"	Realistic Architectural Visualization with3 ds Max and mental ray	2008	"
5	27782	9780240580926	Galer	"	Adobe Photoshop Elements 6 Maximum Performance	2008	"
6	27724	9780240521244	"	"	Photoshop CS4: Essential skills	2008	"
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