



Republic of Zambia

Ministry of Education, Science, Vocational Training and Early Education

COMPUTER SCIENCE SYLLABUS

GRADES 10 TO 12



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VISION

Quality, lifelong education for all which is accessible, inclusive and relevant to individual, national and global needs and value systems.

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TABLE OF CONTENTS

PREFACE	i
ACKNOWLEDGEMENT	ii
RATIONALE	iii
GENERAL OUTCOMES	iii
Key Competences	iii
Suggested Teaching Methodology	iv
TIME AND PERIOD ALLOCATION	vi
ASSESSMENT SCHEME	vi
GRADE 10	1
GRADE 10	2
GRADE 12	15
Grades 10 to 12 Computer Science Scope and Sequence	i
Primary and Secondary School computer hardware recommendations	x
Project Work - School Based Assessment Criteria	xiv

PREFACE

The syllabus was produced as a result of the Curriculum review process carried out by the Ministry of Education, Science, Vocational Training and Early Education under the auspices of the Curriculum Development Centre (CDC). The curriculum reform process started way back in 1999 when the Ministry of Education commissioned five (5) curriculum studies which were conducted by the University of Zambia. These studies were followed by a review of the lower and middle basic and primary teacher education curriculum. In 2005 the upper basic education National survey was conducted and information from learners, parents, teachers, school managers, educational administrators, tertiary institutions traditional leaders civic leaders and various stakeholders in education was collected to help design a relevant curriculum.

The recommendations provided by various stakeholders during the Upper Basic Education National survey of 2005 and National symposium on curriculum held in June 2009 guided the review process.

The review was necessitated by the need to provide an education system that would not only incorporate latest social, economic, technological and political developments but also equip learners with vital knowledge, skills and values that are necessary to contribute to the attainment of Vision 2030.

The syllabus has been reviewed in line with the Outcome Based Education principles which seek to link education to real life experiences that give learners skills to access, criticize analyse and practically apply knowledge that help them gain life skills. Its competences and general outcomes are the expected outcomes to be attained by the learners through the acquisition of knowledge, skills, techniques and values which are very important for the total development of the individual and the nation as a whole.

Effective implementation of Outcome Based Education requires that the following principles be observed: clarity of focus, Reflective designing, setting high expectations for all learners and appropriate opportunities.

It is my sincere hope that this Outcome Based syllabus will greatly improve the quality of education provided at Grade 10 to 12 level as defined and recommended in various policy documents including Educating Our Future 1996 and the Zambia Education Curriculum Framework 2013.

Chishimba Nkocha
Permanent Secretary
MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL TRAINING AND EARLY EDUCATION.

ACKNOWLEDGEMENT

The syllabus presented here is a result of broad-based consultation involving several stakeholders within and outside the education system.

Many individuals, institutions and organizations were consulted to gather their views on the existing syllabus and to accord them an opportunity to make suggestions for the new syllabus. The Ministry of Education wishes to express heartfelt gratitude to all those who participated for their valuable contributions, which resulted in the development of this syllabus.

The Curriculum Development Centre worked closely with other sister departments and institutions to create this document. We sincerely thank the Directorate of Teacher Education and Specialized Services, the Directorate of Planning and Information, the Directorate of Human Resource and Administration, the Directorate of Open and Distance Education, the Examinations Council of Zambia, the University of Zambia, Copperbelt University, schools and other institutions too numerous to mention, for their steadfast support.

We pay special tribute to co-operating partners especially JICA and UNICEF for rendering financial and technical support in the production of the syllabus.

C.N.M Sakala (Mrs.)
Director-Standard and Curriculum
MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL TRAINING AND EARLY EDUCATION

RATIONALE

Computer Science is about how computers compute. It is much more than computer programming. Computer Science is the study of ways of representing objects and processes. It involves defining problems; analysing problems; designing solutions; and developing, testing, and maintaining programs. The term Computer Science refers to the study of computer science, meaning computer and algorithmic processes, including their principles, hardware and software designs, their applications, and the impact they have on society.

The major focus of this subject is the development of programming skills, which are important for success in future postsecondary studies. Computer Science is relevant for all students because it incorporates a broad range of transferable problem-solving skills and techniques, including logical thinking, creative design, synthesis, and evaluation. It also teaches generically useful skills in such areas as communication, time management, organization, and teamwork.

Computer Science will provide students with the knowledge and skills to understand the underpinnings of current computer technology and prepare them for emerging technologies. A foundation in this discipline will introduce students to the excitement and opportunities afforded by this dynamic field and will begin to prepare them for a range of rewarding careers.

The subject will build a strong foundation for those who wish to move on to further study and training in specialized areas such as computer programming, database development and analysis, education, computer engineering, software engineering, information technology, and game development.

GENERAL OUTCOMES

- To build a strong foundation for further study and training in specialized areas such as computer programming, database analysis, education, computer engineering, software engineering, information technology, and game development.

To act as an electronic tool for learning other learning areas

Key Competences

- **Understand and apply requirements of Computer Science ethics and security.**
Learners are expected to be competent in applying the new knowledge so acquired in advancing their daily lives of those of others. They should be able to use computer related software, gadgets and appliances without difficulty. They should also be able to understand the language that is normally used in programming.

Awareness of the risks of using the computer is also important at this level. Software and hardware security is also of great importance at this level.

- **Share their knowledge and skills through the internet**

The Internet is a very powerful media of communication nowadays. After learning CS learners should be able to find useful information using the Internet. They should also be aware of the dangers of using the Internet. The correct use of email addresses for formal communications purposes is vital and. Collaborate and share knowledge and ideas with others.

- **Create simple programs to help the school achieve its goals and other advertisement materials for the school events.**

Learners are expected to be conversant in using multimedia software at this level of education. Learners should be able to correctly use word processing and presentation software.

- **Carry out a simple system design and analysis**

To enhance their understanding at this level learners will be expected to carry out simple system analysis and design in a programming language of their choice.

Suggested Teaching Methodology

Computer Science Syllabus offers a wide perspective of the subject. It gives more insights to the Junior Secondary Information and Communications Technology (ICT) syllabus, bringing to the fore Computer application and its impact on society. Computer Science will be learnt within the context of application. As such, activities, projects and problem solving that replicate real life will form an integral part of the teaching and learning methodologies.

The Senior Secondary School Computer Science syllabus is meant to prepare learners for the world of work (through application), further education within the discipline and lifelong learning. Computer Technology is extremely dynamic and significantly always impacting on the way we live. Learners should be made to appreciate the constantly changing computer technology and its complexities if they are to become competitive citizens in today's globalised world.

Using computers is an essential part of the study of Computer Science. Use of computers in Computer Science facilitates the understanding of and Computer Science processes and inquiry. Using computers can enhance learning opportunities for a wide range of learners because it caters for a variety of learning and teaching styles.

Principles and procedures

Learners need to develop skills to help them learn. Skills development should happen as a part of learners' learning experiences and the learning and practising of skills needs to occur in the context of units being taught.

Learning of Skills tends to be most effective when:

- learners go from the known to the unknown
- learners understand why it is necessary to gain mastery of specific skills
- skills are developed sequentially at increasing levels of difficulty
- learners identify and analyse the components of the skill
- there are frequent opportunities for practice and immediate feedback possibly frequent use of computer or computer embedded gadgets or tools.
- the skills being taught are varied in terms of amount and type, according to the needs and ability of learners

To teach skills effectively, a teacher needs to include learning activities that span from teacher-directed to student-centred learning, use groups of different sizes ranging from the whole class to small groups and use a range of teaching strategies which use higher-order skills as learners' progress.

Teaching and Learning Strategies for Computer Science

Teaching and learning strategies for Computer Science shall include:

Brainstorming - to stimulate creative thinking, Consequence charts - Cause and effect approach, Classroom displays (focuses on the current unit), Charts, Flow charts, Diagrams, Evaluation, Discussion, Guest speaker or visitor, educational tours and visits, Models, Photographs and pictures, Presentations, Problem solving - Learners are involved in identifying and working towards solutions, Reflective learning - thinking about what has been learnt, Research - to think of the questions you want learners to answer, and Project work.

Software

Throughout the course the recommended Operating System (OS) is Microsoft Windows 7. Office 2007 will also be assumed for use to demonstrate word processing (Word), spread sheets (Excel), multimedia, and databases (Access). The programming compilers to be used are Turbo Pascal for Windows and/or C++ , Turbo C++ for Windows .

Pascal programming language is a powerful tool for teaching programming language because of its:

1. **Built in Data Types.** This means that the Pascal programming language contains it's own built in data types of Integer, Real, Character, and Boolean.

2. **User defined Data Types**, which gives Pascal the ability to define scalar, types as well as subranges of those data types.
3. **Provision for a defined set of Data Structures**. This means that data structures include Arrays, Records, Files and Sets.
4. **Strong data typing element**. This means that Pascal compilers can diagnose an incompatible assignment of one type to a variable to another type.
5. **Support for Structured Programming**. This is accomplished through the use of subprograms called procedures and functions.
6. **Simplicity and Expressiveness**. The language is simple and expressive in nature and it allows for effective teaching of computer programming techniques.

TIME AND PERIOD ALLOCATION

This syllabus covers a three-year course in Computer Science and will require at least four 40 minute periods per week to complete (one double for practical and two single periods for theory). Sequence of the syllabus does not necessarily dictate the order in which topics are to be taught.

ASSESSMENT SCHEME

The assessment framework utilises various types of continuous assessment strategies. This is meant to determine learners' competences in the CSc. outcomes presented here. It is desired that the teacher utilise assessment strategies that promote active learning by the learner. The case in point includes portfolios, observation sheets (to gauge certain competences), written assignments and reports, presentations, projects and experiments.

Computer Science is a practical subject and as such this syllabus places a lot of emphasis on the use of common programming languages. Simple object oriented programming languages may be examined at this level. It is therefore the schools' responsibility to ensure that relevant programming software, compilers, equipment and facilities needed by learners to meet the minimum requirements for assessment purposes are acquired.

The teacher may teach learners to dry run simple programs before they actually compile and run them on a compiler. The teacher may choose a programming language for the learners depending on the availability of such 4th generation programming language (4GL). However for uniformity purposes the syllabus assumes Turbo Pascal for Windows and C++.

The final assessment of Computer Science is divided into three sections.

1. School based continuous assessment (SBCA): (20%)
2. Theory (Paper 1) - (External assessment by the examination board): 50%
3. Practical (Paper 2) - (External – Examination board): 30%

Computer Science assessment at senior secondary school level covers the six categories of Bloom's Taxonomy with their respective weightings as shown below:

	SBCA	PAPER 1	PAPER 2	
SKILLS		PERCENTAGE (%)	SKILLS	PERCENTAGE (%)
Knowledge	3	10	Report	5
Comprehension	3	5	4GL Programming project	15
Application	5	10	Demonstration	10
Analysis	3	5		
Synthesis	3	10		
Evaluation	3	10		
TOTAL	20	50		30

It is important that the teacher balances well the teaching of the subject content accordingly. For the full details on paper 2 project work check the appendix (page xiv).

GRADE 10

General Outcomes	Key Competences
<ul style="list-style-type: none">• Promote an appreciation of the range and power of computer application• Develop an interest, confidence and enjoyment in the use of computers	<ul style="list-style-type: none">• Solve problems by using the Help facility in the software application• Apply knowledge and skills using software/ programming to solve related problems in spreadsheet, databases, graphics, web pages and software development.• Share knowledge and skills• Create posters and other advertisement materials for the school events.• Collaborate and share knowledge and ideas with others.• Understand and apply requirements of ICT ethics and security.

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GRADE 10

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
10.1 Computer career opportunities	10.1.1. Careers in ICT 10.1.2. Further Educational opportunities	10.1.1.1 Describe different careers in ICT. 10.1.1.2 Identify opportunities for further education	<ul style="list-style-type: none"> • Careers in ICT(Include: Computer operator, Programmer, Software engineer, Web Designer, Computer Techniiian) • Further education (colleges, polytechnic, universities, and research institutions) 	<ul style="list-style-type: none"> • <i>Interpretation</i> of ICT careers • <i>Identification</i> of opportunities for further education. 	<ul style="list-style-type: none"> • <i>Appreciation</i> of ICT careers • <i>Awareness</i> of ICT careers • <i>Inquisitiveness</i> in ICT jobs and careers.
10.2 Application Software	10.2.1 Generic Application Software.	10.2.1.1 Understand the difference between application and system software. 10.2.1.2 Understand how generic application software may be customised by the use of macros and formulae 10.2.1.3 Appreciate the advantages and disadvantages of generic application software compared with bespoke software 10.2.1.4 Classify types of software 10.2.1.5 Outline the usage of different types of software 10.2.1.6 Distinguish between integrated and stand-	<ul style="list-style-type: none"> • Difference between application and system software. • Word processing and desktop publishing programs • Features of Spread sheet programming (Include: logical conditions e.g. IF (C5>300, C5*5%, “No Discount”) • Use of different types of software (Include: Special purpose application packages for people with special needs) • Integrated and stand-alone software • Off- the-shelf and in- house software 	<i>Differentiation</i> between application and system software <i>Application</i> of features of spreadsheet. <i>Appreciation</i> of disadvantages and advantages of application software.	<i>Inquisitiveness</i> in the use of logical conditions in spreadsheet. <i>Teamwork</i> in the application of spreadsheet and use of logical conditions. <i>Understanding</i> between application and system software.

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
		10.2.1.7 alone software Distinguish between off-the-shelf and in-house software			
11.3 Programing	10.3.1. Programming languages 10.3.2. Program Structure 10.3.3. Programming Reserved Words 10.3.4. Data Types	10.3.1.1 Illustrate the concept of Programming languages 10.3.2.1 Identify program structure 10.3.3.1 Identify programing reserved words in a Programming language (Include: Reserved words in Pascal version 7 and C++ for Windows 7 and 8) 10.3.4.1. Identify Pre-defined Data Types 10.3.4.2. Create User Defined Data types 10.3.4.3. Declare the variables 10.3.4.4. Code simple programs in a programming language (Include: Pascal and C++)	<ul style="list-style-type: none"> • Concept of Programming languages • Program Structure (Include: Program name, variable declaration, beginning, main body, ending) • Use of reserved words (Include: begin, read, write, writeln, readln, end) • Pre-defined data types • User-defined Data types • Types of variables (Include: Real, integers, character, Boolean) • Simple programs in a chosen programming language. 	<ul style="list-style-type: none"> • Manipulations • Identification of reserved words • Problem Solving in programming. • Modelling in finding a solution to a program. • Matching numbers to data type. • Debugging of a computer program. • Application of computer programming to solving simple mathematical and physics problems. 	<ul style="list-style-type: none"> • Appreciation of programming. • Awareness of reserved words in programming. • Logical Thinking in programming computer.

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
10.2 Data Representation and processing	10.2.1. Data and information 10.2.2. Data collection and preparation 10.2.3. Analogue-to-digital converters and digital-to-analogue converters. 10.2.4. Types of data representation 10.2.5. Binary arithmetic operations.	10.2.1.1 Explain the difference between Data and information 10.2.2.1 Describe and select methods of data collection and preparation 10.2.3.1 Describe analogue-to-digital converters and digital-to-analogue conversion. 10.2.5.1 Describe concepts of data representation 10.2.5.2 Outline reasons for data representation 10.2.6.1 Describe the terms for data storage/capacity 10.2.6.1 Explain the number systems and their representation of integral values 10.2.6.2 Demonstrate binary addition and subtraction and their use in computing 10.2.6.3 Explain data processing cycle	<ul style="list-style-type: none"> • Difference between Data and information • Methods of data collection and preparation • Analogue-to-digital converters and digital-to-analogue conversion. • Data representation. • Reasons of data representation • Data storage/capacity (Include: bit, byte) • Number systems and their representation of integral values (decimal, binary, octal and hexadecimal • Binary addition and subtraction and their use in computing • Data processing cycle, errors and data integrity • Types of computer processing file • Electronic data processing modes 	<ul style="list-style-type: none"> • Addition and subtraction of binary numbers. • Modelling/analysis of data and information. • Discrimination between data and information • Trouble shooting when converting of analogue to digital and digital to analogue • Interpretation of data and information. 	<ul style="list-style-type: none"> • Appreciation of storage capacity • Problem solving converting of analogue to digital and digital to analogue • Accuracy in conversions of data <p>Critical and analytical thinking in the presentation of data.</p>
10.3 Hardware of the computer system	10.3.1. Main hardware components of a general-purpose computer 10.3.2. Computers and	10.3.1.1. Investigate different types of input devices 10.3.1.2. Demonstrate usage of each input device 10.3.2.1. Describe the elements of input stage	<ul style="list-style-type: none"> • Types of input devices (Include: mouse, keyboard, scanner , OCR , MICR,OMR, Special purpose input devices for people with special 	<ul style="list-style-type: none"> • Discrimination of main components of a computer system. • Inputting data • Identification of 	<ul style="list-style-type: none"> • Critical and creative thinking on how connected the hardware is in a computer

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
	<p>processing power</p> <p>10.3.3. Input devices and their uses</p> <p>10.3.4. Output devices and their uses</p>	<p>10.3.2.1. Identify the registers</p> <p>10.3.2.2. Demonstrate the principle of fetch – execute cycle</p> <p>10.3.4.1. Identify types of output devices</p> <p>10.3.4.2. Distinguish between the various types of output devices</p>	<p>needs) and their usage.</p> <ul style="list-style-type: none"> • Elements of process stage (memory , control unit , arithmetic and logic unit—ALU) • Types of registers • Principle of fetch – execute cycle • Types of output devices(printer ,Monitor, LCD projectors, Special purpose out devices for people with special needs) 	<p>different components of computer system hardware.</p> <ul style="list-style-type: none"> • Demonstration on the use of computer system hardware • Distinguishing between various types of input 	<p>system.</p> <ul style="list-style-type: none"> • Problem solving in fetching and executing of a cycle.
10.4 Operating systems and file management	<p>10.4.1. Types of operating systems</p> <p>10.4.2. User interface</p> <p>10.4.3. File management</p> <p>10.4.4. Peripheral device control</p>	<p>10.4.1.1. Introduction to operating systems</p> <p>10.4.1.2. Outline different types of operating systems</p> <p>10.4.1.3. Describe the functions of operating systems</p> <p>10.4.1.4. Describe different types of user interface</p> <p>10.4.1.5. Describe types of fileorganisation and access</p> <p>10.4.1.6. File management</p> <p>10.4.1.7. Peripheral device control</p> <p>10.4.1.8. Explain how folders are structured and how folders and files can be managed</p>	<ul style="list-style-type: none"> • Types of operating system (Include: Command line , Graphic User Interface-GUI) • Different types of operating systems • Functions of operating system (Include: task scheduling, memory management, control of input/output) • Different types of user interface • File organisation and access(Include: sequential, direct, random, and serial) • Principles of backing up data (backup, restore) 	<ul style="list-style-type: none"> • Discrimination of operating systems • Problem solving in the using of peripheral devices • Identification of functions of operating systems. • Application of computer peripherals • Appreciation of user interface. • Identification of communication between 	<ul style="list-style-type: none"> • Maintenance of Data integrity • Responsibility in the use of peripherals. • Awareness of data integrity. • Inquisitiveness in the use of operating systems.

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
		10.4.1.9. Describe how the operating system communicates with peripheral devices and maintains data integrity.	<ul style="list-style-type: none"> Managing folders and files Communication between operating system and peripheral devices and maintenance of data integrity. 	operating system with peripheral devices and maintenance of data integrity.	
10.5 Presentation Packages	10.5.1. Introduction to Presentation Packages 10.5.2. Creating slides 10.5.3. Adding animations to slides 10.5.4. Formatting Slides	10.5.1.1 Illustrate the general features of a Presentation Package 10.5.2.1 Demonstrate the various methods of creating slides 10.5.3.1 Describe the steps in adding animations to slides 10.5.4.1 Demonstrate how to format slides	<ul style="list-style-type: none"> Features of a Presentation Package Various methods of creating slides. Adding animations to slides. Formatting slides. 	<ul style="list-style-type: none"> Manipulation of presentation packages Identification of steps needed to create slides. Discrimination Ordering slides Presentations using presentation package 	<ul style="list-style-type: none"> Problem solving in making presentations Logical thinking in animating presentations. Productivity Accuracy in formatting slides.
10.7 General computer applications	10.7.1. Introduction to range and scope of computer applications 10.7.2. Communication in systems 10.7.3. Information systems	10.7.2.1 Demonstrate an understanding of computer applications in a home environment, offices, commercial environment communication and information systems, commercial 10.7.3.1 Identify general data processing, industrial, technical and scientific uses.	<ul style="list-style-type: none"> Application of computers in a home environment (Include: washing machines, Entertainment appliances), offices (Communication- Internet and Intranet), commercial environment (include: - point of sale, stock controls, traffic control) and in training. Data processing, industrial, technical and scientific uses. 	<ul style="list-style-type: none"> Identification of computer applications in homes, offices and commerce. Interpretation of use of computer systems Problem solving in finding a suitable application system for a specific task. Application of 	<ul style="list-style-type: none"> Appreciation of communication and information systems. Critical and analytical thinking in the use of computer systems in a home and information

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
				communication and information systems in a home and workplace.	
10.8 Computer Security (Assets)	10.8.1. Security terminology 10.8.2. Security layers 10.8.3. Security Concerns 10.8.4. Professional Persons involved in security matters 10.8.5. Surveillance of staff	10.8.1.1 Describe security terminologies 10.8.2.1 Describe the systems security policy structure 10.8.3.1 Describe and resolve various security concerns towards resources 10.8.4.1 Identify computer security Professionals 10.8.1.1. Explain the responsibility of computer security professionals	<ul style="list-style-type: none"> • Security terminologies • System Security policy structure • Resources (Assets) that require security • Various security concerns towards resources • Computer security professionals • Responsibilities of computer security personnel 	<ul style="list-style-type: none"> • Identification of security layers. • Comparing and contrasting security layers • Implementation of security measures • Application of security to computers and peripherals. • 	<ul style="list-style-type: none"> • Appreciation of security layers • Awareness of security professionals. • Problem solving • Responsibility computer and data security. • Inquisitiveness in the security measures of a computer system.

GRADE 11

General Outcomes

- Develop an ability to solve problems using computing techniques and programming
- Develop an awareness on the relevance of computing in contemporary society and issues brought about by computer usage
- Gain firm understanding of basic techniques and knowledge required for computer application
- Foster a desire to use computers within other professions

Key Competences

- Apply appropriately search techniques such as Boolean logic, use of advanced search features.
- Apply knowledge and skills using software/ programming to solve related problems in spread sheet, databases, graphics, web pages.
- Be innovative by using appropriate software.
- Make correct decisions about the best features to use within chosen application software.
- Understand and apply requirements of ICT ethics and security.
- Carry out a detailed research programme related to computing.

GRADE 11

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
11.1 Programming and Pseudo Code Algorithms	11.1.1 Computer programming	11.1.1 Identify Programming terminology in Pascal and C++	<ul style="list-style-type: none"> Programming terminology in Pascal and C++(Include: assembler, compiler, interpreter, <i>add, subtract, multiply, divide, calculate</i>) Algorithm for a given problem in pseudocode using a variety of structures and the concepts of totalling and counting. Loops and decision making in a program i.e. conditions and iterations statements(Include: <i>Repeat ... until; if ... then ...else, ... endif, case...of ... otherwise ... endcase, while... do ... endwhile, for ... end for</i>) Dry run with a trace table and test data to understand the behaviour and Work out the purpose of a pseudo code algorithm. Trace table for pseudocode. Elements of logic gates 	<ul style="list-style-type: none"> Identification of reserved words Debugging of a computer program. Application of computer program Manipulation of programming languages Identification of components of a programming language 	<ul style="list-style-type: none"> Productivity in the use of programming languages Creativity in programming.
	11.1.2	11.1.2 Produce an algorithm for a given problem in pseudocode using a variety of structures and the concepts of totalling and counting			
	11.1.3 Produce loops and decision making in a program.				
	11.1.4 Use a dry run with a trace table and test data to understand the behaviour of code.				
	11.1.5 Work out the purpose of a pseudo code algorithm.				
	11.1.6 Construct trace table for pseudocode.				
11.2 Logic gates, circuits and Website designing	11.2.1. Logic gates and circuits	11.2.1.1 Define functions of five types of of logic gates and recognise their symbols	<ul style="list-style-type: none"> Five types of logic gates and recognise their symbols (Include: AND, OR , NOR , NAND , NOT) 	<ul style="list-style-type: none"> Problem solving in the use of logic gates Demonstration 	<ul style="list-style-type: none"> Entrepreneurship in creating simple websites. Accuracy in the
	11.2.2. Introduction to Web site				

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
	Design and Development	11.2.1.2 Write a truth table for a given gate and recognise a gate from its truth table 11.2.1.3 Produce a truth table for a given logic circuit 11.2.1.4 Design a simple logic circuit to provide a solution to a written logical statement of a problem. 11.2.2.1. Create Web Pages using templates (Include: HTML and Design windows in Dreamweaver). 11.2.2.2. Import text and pictures in a web designer. 11.2.2.3. Use Flash to animate files and pictures in websites.	<ul style="list-style-type: none"> • Truth tables for a given gate. • Logic circuits. • Web Pages • Text and pictures in a web designer. • Flash to animate files and short videos in websites. 	<ul style="list-style-type: none"> • on creating web pages using Dreamweaver. • Appreciation of web designing. • Previewing a web site design. 	<ul style="list-style-type: none"> • use of logic gates. • Inquisitiveness in the use of web designing software. • Modelling in finding a solution to a program.
11.3 Networks and Data Communication	11.3.1. Networks Purpose and limitations 11.3.2. Elements of Networking 11.3.3. Network Types and topologies 11.3.4. Analogue-to-digital converters and digital-to-analogue	11.3.1.1 Define computer networks and data communication 11.1.1.2 Explain the purpose and limitations of networks 11.3.2.1 Identify the elements of Networks 11.3.3.1 Name the types of networks and topologies 11.3.4.1 Converting	<ul style="list-style-type: none"> • Computer networks and data communication • Purpose (include: resource sharing, remote communication, distributed processing facilities, cost effectiveness and reliability) • Limitations of networking • Elements of a Networks- 	<ul style="list-style-type: none"> • Interpretation of various networks • Identification digital converters. • Awareness of data protection legislation. • Awareness of recent developments in the use of the 	<ul style="list-style-type: none"> • Appreciation of the use of networks. • Inquisitiveness of use of networks. • Understanding of various networks and topologies

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
	converters 11.3.5. Data capture and checking 11.3.6. Data protection legislation 11.3.7. Computer crime 11.3.8. Computer viruses 11.3.9. Internet security 11.3.10. Recent developments in the use of the Internet	analogue-to-digital converters and digital-to-analogue converters 11.3.5.1 Identify Data capture and checking 11.3.6.1 Demonstrate data protection legislation 11.3.7.1 Identify Computer crime 11.3.8.1 Discuss consequences of Computer viruses 11.3.9.1 Identify Internet security 11.3.10.1 Discus recent developments in the use of the Internet	Data communication media (cables and wireless), Data signal (digital and analogue), Communication devices (modems, network cards and hubs) and Network software (operating systems and protocols) • Types of networks (Include: local area networks-LAN, wide area networks-WAN and metropolitan area networks-MAN) • Network topologies (Include: star, bus and ring) • Analogue-to-digital converters and digital-to-analogue converters • Data capture and checking • Data protection legislation • Computer crime • Consequences of Computer viruses (Include: Antiviruses, bad programs) • Internet security • Recent developments in the use of the Internet.	Internet. • Application of networks to communicate	
11.4 Computer system	11.4.1. Types of	11.4.1.1 Distinguish between	• Types of computer system	• Identification of	• Inquisitiveness in

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
	computer systems 11.4.2. Describe monitoring and control systems 11.4.3. Automation and robotics applications 11.4.4. Expert systems and artificial intelligence 11.4.5. Management of computer systems.	types of computer system 11.4.2.1 Illustrate what is needed to support various types of computer system 11.4.3.1 Explain the most suitable type of computer system for a given application. 11.4.4.1 Explain information systems for on-line services and remote databases 11.4.5.1 Describe monitoring and control systems 11.4.6.1 Describe the automation and robotics applications 11.4.7.1 Describe expert systems and artificial intelligence 11.4.8.1 Describe problems in the managements of computer systems.	(Include: Batch processing systems, interactive systems, control systems, automated systems). <ul style="list-style-type: none"> Information system for on-line services and remote databases. Monitoring and control systems Automation and robotics applications Expert systems and artificial intelligence Management of computer systems. 	databases and their use. <ul style="list-style-type: none"> Awareness of databases concepts. Appreciation of multimedia systems. Problem solving in management of computer system. 	web browsers and their use. <ul style="list-style-type: none"> Productivity in the use of web browsers and search engines. Appreciation of expert and artificial intelligence. Understanding of automation and robotics application. Inquisitiveness in automation and robotics. Curiosity in expert systems and artificial intelligence.
11.5 Databases	11.5.1 Design Databases	11.5.1.1. Build a database 11.5.1.2. Describe Relationships 11.5.1.3. Illustrate Data entry and edit 11.5.1.4. Redesigning a table	<ul style="list-style-type: none"> Databases (Include: creating a new data base, new table, auto number field, fields, primary key) Relationships (Include: Making the relationship, table wizard, checking relationships) Data entry and edit Tables (Include: Adding 	<ul style="list-style-type: none"> Application of databases and multimedia systems. 	<ul style="list-style-type: none"> Inquisitiveness in use of databases. Curiosity in the use of databases.

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
			and deleting fields)		
11.6 Social and economic implications use of computers and their implications	11.6.1. Effects of Computer use on people and organisation 11.6.2. Maintenance of integrity of data and privacy. 11.6.3. Data protection legislation. 11.6.4. Threats to computer security and measures to combat them.	11.6.1.1. Introduction to understanding of some social and economic effects of computer use on people and organisation 11.6.1.2. Demonstrate an understanding of some social and economic effects of computer use on people and organisation 11.6.1.3. Describe measures to maintain integrity of data and privacy. 11.6.3.1. Describe features expected in data protection legislation. 11.6.4.1. Demonstrate an understanding of threats to security and measures to combat them.	<ul style="list-style-type: none"> • Social and economic effects of computer use on people and organisation • Data integrity and privacy. • Data protection legislation. • Threats to security and measures to combat them (Include: hacking and other computer crime, computer viruses, internet security). 	<ul style="list-style-type: none"> • Differentiation of risk threats and controls. • Implementation of security systems. • Planning security for a system. • Awareness of security and access to computer systems. 	<ul style="list-style-type: none"> • Appreciation of security controls. • Security consciousness • Security management of the systems. • Inquisitiveness in keeping hackers away from computer systems.
11.7 Specific computer applications	11.7.1. Education 11.7.2. Health 11.7.3. Banking 11.7.4. Retailing 11.7.5. Library systems 11.7.6. Office automation 11.7.7. Commercial and general	11.7.1.1 Describe the use of computers in education 11.7.2.1 Describe the use of computers in health 11.7.3.1 Describe the use of computers in banking 11.7.4.1 Describe the use of computers in retailing 11.7.5.1 Describe Library	<ul style="list-style-type: none"> • Computers in education (Include: e-learning, e-books, on-line application) • Computers in health (Include: medical expert systems, tele-medicine, health research, record keeping, medical diagnosis) • Computers in banking 	<ul style="list-style-type: none"> • Application of computers in library systems. • Searching for books using a library system • Researching in commercial and general data 	<ul style="list-style-type: none"> • Appreciation of use of computer system in a library. • Awareness of use of computers in a library. • Entrepreneurship in tracking of

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
	data processing.	<p>systems</p> <p>11.7.6.1 Identify Office automation</p> <p>11.7.7.1 Define Commercial and general data processing.</p>	<p>(Include: Electronic fund transfer, automated teller machines, credit cards, online banking)</p> <ul style="list-style-type: none"> • Computers in retailing (Include: electronic point of sale, stock management. • Library systems • Office automation • Define Commercial and general data processing. 	<p>processing.</p> <ul style="list-style-type: none"> • Application of computers in retailing. • Understanding of computer systems in library and retailing. 	<p>sales using a computer system.</p> <ul style="list-style-type: none"> • Problem solving in a library system and banking. • Innovativeness in the use of computers in a data processing system.

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GRADE 12

General Outcomes	Key Competences
<ul style="list-style-type: none">• Develop an ability to solve problems using computing techniques• Develop an awareness on the relevance of computing in contemporary society and issues brought about by computer usage• Gain firm understanding of basic techniques and knowledge required for computer application• Foster a desire to use computers within other professions	<ul style="list-style-type: none">• Apply appropriately search techniques such as Boolean logic, use of advanced search features.• Apply knowledge and skills using software/ programming to solve databases, graphics, web pages and software development.• Be innovative by using appropriate software.• Make correct decisions about the best features to use within chosen application software.• Understand and apply requirements of ICT ethics and security.• Carry out a detailed research programme related to computing.• Collaborate and share knowledge and ideas with others.

GRADE 12

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
12.1 System Development	11.7.1 Introduction to System analysis and development	<p>12.7.1.1. State the stages of the system life cycle in a logical order.</p> <p>12.7.1.2. Justify the choice of suitable methods for fact finding.</p> <p>12.7.1.3. Described feasibility study.</p> <p>12.7.1.4. Describe analysis</p> <p>12.7.1.5. Use dataflow diagrams and system flow charts as tools.</p> <p>12.7.1.6. Produce a plan for a project using a Gantt chart</p> <p>12.7.1.7. Describe design</p> <p>12.7.1.8. Explain top down design and use structure diagrams as tools.</p> <p>12.7.1.9. Describe appropriate testing strategies and choose suitable data for testing.</p> <p>12.7.1.10. State items that should be included in technical and use documentation.</p> <p>12.7.1.11. Justify the choice of a method of changeover</p> <p>12.7.1.12. Describe how a system should be evaluated</p>	<ul style="list-style-type: none"> • Stages of the system life cycle in a logical order (Include: fact finding, feasibility study, analysis, design, building and testing, documentation, implementation (changeover), evaluation, maintenance. • Methods for fact finding. • Feasibility study. • System analysis • Dataflow diagrams and system flow charts as tools. • Project plan using a Gantt chart • System design • Top-down design and use structure diagrams as tools. • System testing strategies • Items to be included in technical and use documentation. • Method of changeover • System evaluation • System maintenance. 	<ul style="list-style-type: none"> • Understanding of system life cycle. • Identification of stages of a system life cycle. • Communication through flow charts and diagrams. • Designing of a system life cycle. • Researching of a system life cycle • Analysis of various stages of a system life cycle. 	<ul style="list-style-type: none"> • Team work in the system life cycle. • Skilfulness of identifying system life cycle. • Analytical and critical thinking in constructing a system life cycle. • Logical thinking in constructing Gantt Charts and flowcharts.

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
		12.7.1.13. Describe how a system should be maintained.			
12.1 Algorithms	12.1.1 Algorithm planning and design	12.1.1.1. Describe the stages in making an overall plan to solve a problem. 12.1.1.2. Explain algorithms and their relationship to a larger system. 12.1.1.3. Describe and use tools to design programs and algorithms. 12.1.1.4. Design, interpret and test algorithms.	<ul style="list-style-type: none"> • Stages in making an overall plan to solve a problem. • Algorithms and their relationship to a larger system. • Tools to design programs and algorithms. • Algorithms. 	<ul style="list-style-type: none"> • Planning how to solve a problem. • Identification of stages in making an overall plan to solve a problem. • Application of algorithms in a larger system. 	<ul style="list-style-type: none"> • Inquisitiveness in algorithms planning. • Understanding of the role algorithms play in a major program. • Appreciation of use of algorithms in a program.
12.2 Programming and Structure Query language (SQL)	12.2.1. Describe the elements of Structured Query Language (SQL). 12.2.2. Design a SQL application architecture. 12.2.3. Manage databases.	12.2.1.1. Introduction to SQL and Databases 12.2.1.2. Install, Run & Write SQL Statement 12.2.3.1. Draw and Display Data Sets 12.2.3.2. Modify Data base 12.2.3.3. Generate Queries & Lists 12.2.3.4. Display data sheets (Include: Gridlines, hiding and showing columns, Fonts, Print preview, page setup) 12.2.3.5. Sort and search a database (Include: Find, filter by selection, multi-table queries, setting the Query criteria)	<ul style="list-style-type: none"> • SQL and Databases • Database Installation • Databases and Tables • Filtering Records • DML: Data Manipulation Language,(Include: Insert, Update, and Delete) • Joins –Querying Data from Multiple Tables • Using Views • Reusing queries. 	<ul style="list-style-type: none"> • Manipulation of databases • Application of databases to real life situations. • Creating databases from given situations. 	<ul style="list-style-type: none"> • Understanding use of structured query language • Inquisitiveness of use of databases. • Productivity in use of databases. • Appreciation of use of databases and SQL.
12.3 Computer Project	12.3.1 Project planning,	12.3.1.1. Demonstrate the skills	<ul style="list-style-type: none"> • Project planning 	<ul style="list-style-type: none"> • Planning of 	<ul style="list-style-type: none"> • Efficiency in the

TOPIC	SUB TOPIC	SPECIFIC OUTCOME	KNOWLEDGE	SKILLS	VALUES
	database development and systems development.	<p>in project planning,</p> <p>12.3.1.2. Use simple programming to develop database systems</p> <p>12.3.1.3. Comprehensively write a computer system Report (Relate it to stages of a system analysis and design).</p> <p>12.3.1.4. Demonstrate System Product.</p>	<ul style="list-style-type: none"> • Database development • System development • System product. 	<p>projects</p> <ul style="list-style-type: none"> • Monitoring of projects • Designing of the final project report • Demonstration of system product. 	<p>use of system development.</p> <ul style="list-style-type: none"> • Productivity in the use of databases. • Appreciation of the use of system product.
12.4 Types of computer systems	<p>12.4.1. Batch processing systems</p> <p>12.4.2. Interactive systems</p> <p>12.4.3. Network systems</p> <p>12.4.4. Control systems</p> <p>12.4.5. Automated systems</p> <p>12.4.6. Multimedia systems and applications</p>	<p>12.4.2.1. Describe concepts of Batch processing systems</p> <p>12.4.2.2. Describe Interactive systems</p> <p>12.4.2.3. Demonstrate Network systems</p> <p>12.4.2.4. Describe Control systems</p> <p>12.4.2.5. Describe Automated systems</p> <p>12.4.2.6. Demonstrate Multimedia systems and their applications</p>	<ul style="list-style-type: none"> • Batch processing systems • Interactive systems • Network systems • Control systems • Automated systems • Multimedia systems and applications 	<ul style="list-style-type: none"> • Identification of Batch processing systems • Application of Networks, Control systems, automated systems, Multimedia systems. • Demonstrate use of multimedia systems. 	<ul style="list-style-type: none"> • Inquisitiveness of automated systems usage. • Appreciation of networks or systems. • Awareness of batch processing systems.

Grades 10 to 12 Computer Science Scope and Sequence

The table below shows the coverage of the syllabus in Computer Science from Grades 10 to 12. It is important for a teacher to refer to this table from time to time to know the knowledge that the learners already have or need to have at various levels of learning of the subject.

TOPIC	SPECIFIC OUTCOMES		
	GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> Computer career opportunities 	<ul style="list-style-type: none"> Describe different careers in ICT. Identify opportunities for further education 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">
<ul style="list-style-type: none"> Programming and Pseudocode Algorithms 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Identify Programming terminology in Pascal and C++ Produce an algorithm for a given problem in pseudocode using a variety of structures and the concepts of totalling and counting Produce loops and decision making in a program. Use a dry run with a trace table and test data to understand the behaviour. Work out the purpose of a pseudo code algorithm. Construct trace table for pseudocode. 	<ul style="list-style-type: none">

TOPIC	SPECIFIC OUTCOMES		
	GRADE 10	GRADE 11	GRADE 12
<ul style="list-style-type: none"> System Development 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> State the stages of the system life cycle in a logical order. Justify the choice of suitable methods for fact finding. Described feasibility study. Describe analysis Use dataflow diagrams and system flow charts as tools. Produce a plan for a project using a Gantt chart Describe design Explain top down design and use structure diagrams as tools. Describe appropriate testing strategies and choose suitable data for testing. State items that should be included in technical and use documentation. Justify the choice of a method of changeover Describe how a system should be evaluated Describe how a system should be maintained.
<ul style="list-style-type: none"> Application Software 	<ul style="list-style-type: none"> Understand the difference between application and system software. Understand how generic application software may be customised by the use of macros and formulae 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">

TOPIC	SPECIFIC OUTCOMES		
	GRADE 10	GRADE 11	GRADE 12
	<ul style="list-style-type: none"> • Appreciate the advantages and disadvantages of generic application software compared with bespoke software • Classify types of software • Outline the usage of different types of software • Distinguish between integrated and stand-alone software • Distinguish between off-the-shelf and in-house software 		
<ul style="list-style-type: none"> • Logic gates, algorithms, circuits and Website designing 	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • Define functions of five types of logic gates and recognise their symbols • Write a truth table for a given gate and recognise a gate from its truth table • Produce a truth table for a given logic circuit • Design a simple logic circuit to provide a solution to a written logical statement of a problem. • Create Web Pages using templates (Include: HTML and Design windows in Dreamweaver,). • Import text and pictures in a web designer. 	<ul style="list-style-type: none"> • Describe the stages in making an overall plan to solve a problem. • Explain algorithms and their relationship to a larger system. • Describe and use tools to design programs and algorithms. • Design, interpret and test algorithms.

TOPIC	SPECIFIC OUTCOMES		
	GRADE 10	GRADE 11	GRADE 12
		<ul style="list-style-type: none"> Use Flash to animate files and pictures in websites. 	
<ul style="list-style-type: none"> Programming and Structured Query Language (SQL) 	<ul style="list-style-type: none"> Illustrate the concept of Programming languages Identify program structure Identify programming reserved words in a Programming language (Include: Reserved words in Pascal and C++) Identify Pre-defined Data Types Create User Defined Data types Declare the variables Code simple programs in a programming language (Include: Pascal for Windows and C++) 	<ul style="list-style-type: none"> Build a database Describe Relationships Illustrate Data entry and edit Redesigning a table 	<ul style="list-style-type: none"> Introduction to SQL and Databases Install, Run & Write SQL Statement Create Database Draw and Display Data Sets Modify Data base Generate Queries and Lists
<ul style="list-style-type: none"> Networks and Data Representation and processing 	<ul style="list-style-type: none"> Explain the difference between Data and information Describe and select methods of data collection and preparation Describe analogue-to-digital converters and digital-to-analogue conversion. 	<ul style="list-style-type: none"> Define computer networks and data communication Explain the purpose and limitations of networks Identify the elements of Networks Name the types of networks and topologies Converting analogue-to-digital 	<ul style="list-style-type: none">

TOPIC	SPECIFIC OUTCOMES		
	GRADE 10	GRADE 11	GRADE 12
	<ul style="list-style-type: none"> Describe concepts of data representation Outline reasons for data representation Describe the terms for data storage/capacity Explain the number systems and their representation of integral values Demonstrate binary addition and subtraction and their use in computing Explain data processing cycle 	<ul style="list-style-type: none"> converters and digital-to-analogue converters Identify Data capture and checking Demonstrate data protection legislation Identify Computer crime Discuss consequences of Computer viruses Identify Internet security Discus recent developments in the use of the Internet 	
<ul style="list-style-type: none"> Types of Computer system 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Distinguish between types of computer system Illustrate what is needed to support various types of computer system Explain the most suitable type of computer system for a given application. Explain information systems for on-line services and remote databases Design Databases Describe monitoring and control systems Describe the automation and 	<ul style="list-style-type: none"> Describe concepts of Batch processing systems Describe Interactive systems Demonstrate Network systems Describe Control systems Describe Automated systems Demonstrate Multimedia systems and their applications

TOPIC	SPECIFIC OUTCOMES		
	GRADE 10	GRADE 11	GRADE 12
		robotics applications <ul style="list-style-type: none"> Describe expert systems and artificial intelligence Describe problems in the managements of computer systems. 	
<ul style="list-style-type: none"> Computer Project 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Demonstrate the skills in project planning, Use simple programming to develop database systems Comprehensively write a computer system Report (Relate it to stages of a system analysis and design). Demonstrate System Product.
<ul style="list-style-type: none"> Hardware of the computer system 	<ul style="list-style-type: none"> Investigate different types of input devices Demonstrate usage of each input device Describe the elements of input stage Identify the registers Demonstrate the principle of fetch – execute cycle Identify types of output devices Distinguish between the various types of output devices 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">
<ul style="list-style-type: none"> Operating systems and file management 	<ul style="list-style-type: none"> Introduction to operating systems 	<ul style="list-style-type: none"> Introduction to understanding of some social and economic 	<ul style="list-style-type: none">

TOPIC	SPECIFIC OUTCOMES		
	GRADE 10	GRADE 11	GRADE 12
	<ul style="list-style-type: none"> Outline different types of operating systems Describe the functions of operating systems Describe different types of user interface Describe types of file organisation and access File management Peripheral device control Explain how folders are structured and how folders and files can be managed Describe how the operating system communicates with peripheral devices and maintains data integrity. 	<p>effects of computer use on people and organisation</p> <ul style="list-style-type: none"> Demonstrate an understanding of some social and economic effects of computer use on people and organisation Describe measures to maintain integrity of data and privacy. Describe features expected in data protection legislation. Demonstrate an understanding of threats to security and measures to combat them. 	
<ul style="list-style-type: none"> Presentation Packages 	<ul style="list-style-type: none"> Illustrate the general features of a Presentation Package Demonstrate the various methods of creating slides Describe the steps in adding animations to slides Demonstrate how to format slides 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">
<ul style="list-style-type: none"> Specific computer applications 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Describe the use of computers in education Describe the use of computers 	<ul style="list-style-type: none">

TOPIC	SPECIFIC OUTCOMES		
	GRADE 10	GRADE 11	GRADE 12
		<ul style="list-style-type: none"> in health • Describe the use of computers in banking • Describe the use of computers in retailing • Describe Library systems • Identify Office automation • Define Commercial and general data processing. 	
<ul style="list-style-type: none"> • General Computer Applications 	<ul style="list-style-type: none"> • Demonstrate an understanding of computer applications in in a home environment, offices, commercial environment communication and information systems, commercial • Identify general data processing, industrial, technical and scientific uses. 	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • Describe how computers are used to control processes in an industry • Identify positives and negatives of computers in employment • Describe the effects of computers on people’s rights to privacy • Describe effects of electronic transactions • Describe social effects of computers
<ul style="list-style-type: none"> • Computer Security (Assets) 	<ul style="list-style-type: none"> • Describe security terminologies • Describe the systems security policy structure • Describe and resolve various security concerns towards resources • Identify computer security Professionals • Explain the responsibility of 	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> •

TOPIC	SPECIFIC OUTCOMES		
	GRADE 10	GRADE 11	GRADE 12
	computer security professionals		

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Primary and Secondary School computer hardware recommendations

PCs are required to teach Computer Studies and Computer Science subjects at both Primary and secondary level.

Effective teaching of computer related subjects could take place with computers based in a dedicated computer laboratory (Micro Lab). It is recommended that the laboratory should be air conditioned with hard floor. The estimated cost for building a Micro lab is beyond the jurisdiction of CDC, let alone faculty of natural sciences, but the CDC can advise the Ministry of Education of the specifications needed.

Hardware

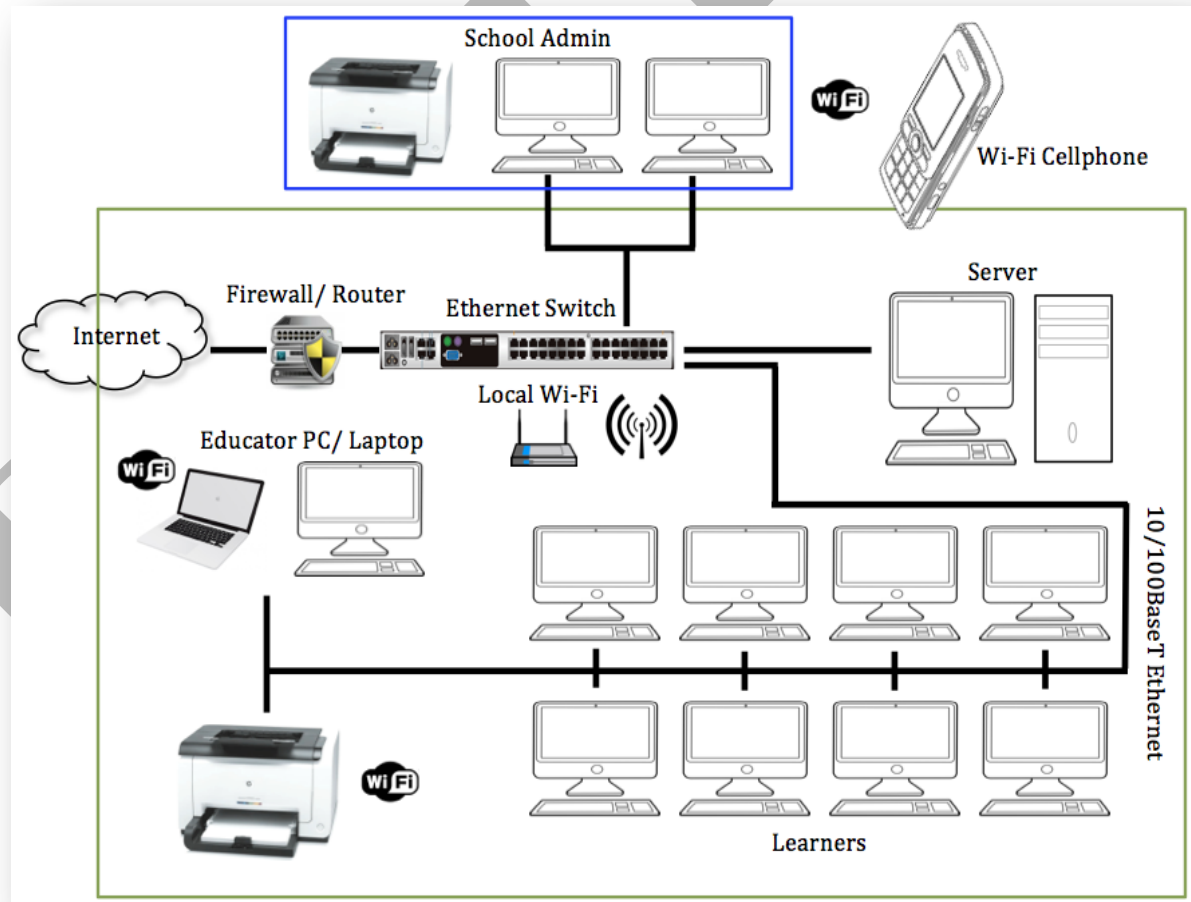
The Ministry of Education recommends the computer system that has “server-client” configurations that may have stand-alone workstations. However due to cost constraints schools may consider “thin-client” configurations, such as server with dumb terminals.

Printers will be mostly monochrome with colour as an option. Colour printers may not be recommended due to their expensive nature to maintain and run. Some peripherals that the school will need:

	Peripherals	Number
1	HP Printer P4515dn	2
2	Data Projectors/Interactive whiteboards (IWB)	1
3	Uninterrupted power supply	45
4	Computer (Stand alone)	45

Some powerful PCs can be used as servers to share resources (e.g. optical drives). The use of uninterrupted power supply (UPS) backup power for servers is recommended.

The diagram opposite shows a recommended school network of computers and peripherals.



Software

The following table depicts the software that is recommended for use in secondary schools.

A typical problem experienced by the Ministry is that some schools receive donations of outdated equipment that do not address educational requirements. This document provides specifications for donated equipment to ensure that schools are able to accept and utilise such equipment effectively.

The following are specification for refurbished equipment that will fulfill the average computer needs in a school. Older equipment will typically be more expensive to maintain and may perform below required standards.

Its also important that school managers are mindful that schools are not turned into e-waste dumping grounds.

Learners' desktops

The following are the minimum specifications for the learners' computer. Take note that these are just minimum specifications:

1. **2.4GHz (Celeron or Pentium 4) CPU.**
2. **At least 3 GB RAM.**
3. **300GB or higher hard drive disk (HDD), or 300GB of SSD – solid state drive.**
4. **15" LCD monitor.**
5. **10/100BaseTX Ethernet card or Wi-Fi Card (or Dongle).**

Leaners at all levels may not be allowed to store their work on the computers but may be encouraged to use flash ram for their work. The teachers to avoid misuse or prevention of viruses from other computers may keep these flash rams.

Teachers' Desktops

These computers should be able to also work as file or print servers so that the teacher can monitor the learners' work.

Specifications:

	Description	Number
1	Operating systems.	
	Windows 7 (Any Version: Basic, Premium or Professional)	1
2	Generic Software	
	Full Version of Office 2007 or higher version	40
	Adobe Dreamweaver CS5 or higher	40
	Adobe Flash CSS5 or higher	40
	Antivirus (On server)	1
3	Compiler	
	Turbo Pascal 7 for Windows (Corporate license)	4
	C++ for Windows (Corporate license)	4
	Microsoft Visual Basic (Later version)	
	Microsoft Visual Studio 10 (Corporate license)	4

• A full version of Microsoft Office should include Word processor, Spreadsheet application, Desktop Publisher

Desktop PC Bundle, an integrated desktop as shown, (Intel Pentium G2030 3GHz Processor, 4GB RAM, 500GB HDD, Windows 8 or Windows 7)

This option of desktops combines both processor and LCD in one. The following gives a summary of the specifications:

1. Screen Size:	23 inches
2. Processor:	Brand Intel
3. Processor Speed:	3 GHz
4. Processor Count:	2
5. RAM Size:	4 GB
6. Computer Memory Type:	DDR3 SDRAM
7. Hard Drive Size:	500 GB HDD OR SSD
8. Graphics Card Description	NVIDIA GeForce GT 710A (1GB dedicated)
9. Graphics RAM Type:	DDR3 SDRAM
10. Graphics Card Ram Size:	1 GB
11. Wi-Fi:	Inbuilt Wi-Fi.



Ideally, a maintenance and support agreement (a 2-3 year on-site warranty) should accompany both bought and donated computers to ensure the availability of the system to teachers and learners.

The following is a list some of the equipment that may be supplied by the ISP (internet Service Provider):

- Firewall/ Router
- Cables
- Wi-Fi routers
- Wi-Fi cards
- Ethernet Switch
- Internet radio and mast

Other Hardware

Other hardware or software maybe be considered to be important can be sourced by the school. The following specification may be considered for the schools that may need tablets for their work especially lower primary school:

1. 10.1" Inch Dual Core Multi-Touch Capacitive
2. 1.2 GHz of speed
3. Google Android 4.2 Jellybean Android Operating System (you can download 1000's of apps available on the Google Play store)

4. 1GB MID Tablet PC 8 GB NAND internal storage and up to the 32GB expandable storage
5. HDMI, Wi-Fi & Bluetooth,
6. Flash 10.3 Player,
7. Dual Camera,
8. 3G or 4G capability
9. 1024 X 600 resolution

The illustration below is a typical example of a tablet that runs Google Android 4.2 Jellybean OS or better.



- An example of a recommended tablet operating on Android 4.2 Jellybean with some of the free downloaded applications (Apps).

NOTE: The school may download appropriate academic applications (Apps) that can be used on the tablet shown above. The school may buy a central hard drive disk that can accommodate all the applications that can be used at various grades on the tablet. These applications may also be downloaded directly on to it (tablet) from the Internet through the *Play Store* (see icon for play store on the illustration above). This tablet may also be found useful at all levels of education.

Project Work - School Based Assessment Criteria

The examiner may not recommend the use of any specific programming language; the Centre should choose the language according to the resources available and the ability of the learners to use that particular programming language. Pascal and C++ may be recommended but learners may use any other language to do their projects. However the choice of language must allow them to construct their programs using a structured modular approach.

Centre Number Centre Name:.....

Candidate Number Candidate:.....

DOMAIN	SUB DOMAIN	DETAILS	Minimum Mark	Mark obtained
ANALYSIS	Description of the Problem	Includes the nature of the problem to be solved	2	
	Objectives	To be stated within the context of the project.	2	
	Description of existing solution	Description of the current solution, including data input requirements and output methods.	2	
	Evaluation of existing solution	Evaluation of the current solution highlighting advantages, disadvantages.	2	
	Description of possible solutions	Description of the proposed solution to the problem description after evaluating the existing problem	2	

DOMAIN	SUB DOMAIN	DETAILS	Minimum Mark	Mark obtained
DESIGN	Action plan	Detailed action plan, including Gant Chart	2	
	Systems Flowchart	Full solution represented in system flowchart with correct use of symbols	3	
	Description of method of solution	relevant to the problem relevant to the problem.	3	
	Hardware	Specification of hardware that can do the job OR A list of hardware giving at least two reasons why such hardware is needed in the context of the proposed solution	2	
	Software	A list or description of software and why the software can work on the intended system.	3	
IMPLEMENTATION	Method of solution related to problem identified.	Method of solution related to the problem by suitable means of solving the problem, including 4GL programming and coding, spreadsheet formulas, database programming and tables, site plans of website using Dreamweaver or other website design software.	3	
	Accurate method of solution	Demonstration of accuracy of the methods used and software.	2	
	Programming code	Accurate use of a 4GL language with good comments and annotations.	2	

DOMAIN	SUB DOMAIN	DETAILS	Minimum Mark	Mark obtained
TESTING	Test strategy	Complete test strategy, which must include the data to be tested together with the expected results	1	
	Test results	The system developed should be able to test acceptable (normal), Unacceptable (abnormal) and boundary (extreme) data). Full credit if all can be tested adequately.	6	
DOCUMENTAION	Technical documentation	Overall report (should include: contents page and clear and complete Documentation.)	2	
	User guide	User guide should be clear and complete user guide	2	
System Development and Evaluation.	Evaluation	Reasonable evaluation linked to the computer Objectives testing	1	
	Developments	Meaningful suggestions and improvements for development of the system.	2	
FINAL TOTAL			20%	

Name and signature of examiner:

School Date Stamp: