



Republic of Zambia

Ministry of General Education

Science, Technology, Engineering and Mathematics (STEM) for Secondary Education

Computer Science

Grade 10 - 12

Transitional Syllabus



Prepared and Published by Curriculum Development Centre

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The National Anthem of Zambia

Stand and sing of Zambia, proud and free,
Land of work and joy in unity,
Victors in the struggle for the right,
We've won freedom's fight.
All one, strong and free.

Africa is our own motherland,
Fashion'd with and blessed by God's good hand,
Let us all her people join as one,
Brothers under the sun,
All one, strong and free.

One land and one nation is our cry,
Dignity and peace 'neath Zambia's sky
Like our noble eagle in its flight,
Zambia- praise to thee.
All one, strong and free.

Chorus

Praise be to God,
Praise be, praise be, praise be,
Bless our great nation,
Zambia, Zambia, Zambia
Free men we stand
Under the flag of our land
Zambia- praise to thee!
All one, strong and free.

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Vision of the Country

A prosperous middle-income Nation by 2030

Vision of Education

Quality life-long education for all which is accessible, inclusive and relevant to individual, national and global needs and value systems

Mission of Education

To guide the provision of education for all Zambians so that they are able to pursue knowledge and skills, manifest excellence in performance and moral uprightness, defend democratic ideals, and accept and value other persons on the basis of their personal worth and dignity, irrespective of gender, religion, ethnic origin, or any other discriminatory characteristic.

Goals of Education

1. Producing a learner capable of:
 - a. Being animated by a personally held set of civic, moral and spiritual values;
 - b. Developing an analytical, innovative, creative and constructive mind;
 - c. Appreciating the relationship between scientific thought, action and technology on the one hand, and sustenance of the quality of life on the other;
 - d. Demonstrating free expression of one's own ideas and exercising tolerance for other people's views;
 - e. Cherishing and safeguarding individual liberties and human rights;
 - f. Appreciating Zambia's ethnic cultures, customs and traditions, and upholding national pride, sovereignty, peace, freedom and independence;
 - g. Participating in the preservation of the ecosystems in one's immediate and distant environments;
 - h. Maintaining and observing discipline and hard work as the cornerstones of personal and national development
2. Increasing access to education and life skills training
3. Building capacity for the provision of quality education
4. Creating conditions for effective coordination of policies, plans and programmes
5. Rationalizing resource mobilization and utilization.

Foreword

In an effort to promote human capital development proficient in contributing to national development, the Government of the Republic of Zambia is implementing STEM Education as one cardinal way, amongst others, of nurturing the much-needed talent and energy of the learners. STEM Education requires critical understanding and interpretation of the curriculum by teachers to enable them plan and deliver lessons that will engage learners and provoke creativity, innovativeness and critical thinking as envisaged in the Seventh National Development Plan (7NDP) roadmap. This syllabus seeks to provide education that would bring about discipline of mind and good character through acquisition of right competences by learners to be able to contribute to national development. This calls for competence among teachers and requires learning beyond the classroom; migration from conception to products, perception to reality and formalities to requirements. Therefore, the publication of this STEM Education Syllabus cannot be understated.

I thank the Minister of General Education for the tireless effort in providing informed direction on STEM Education implementation. I also thank Director Standards & Curriculum and Director National Science Centre for the technical support rendered in developing this STEM Syllabus. Sincere thanks go to all the other departments and institutions too numerous to mention for providing leadership in supporting STEM Education. Further appreciation goes to the Curriculum Development Centre (CDC) and National Science Centre teams who developed this syllabus as the bed rock of the future of STEM Education in Zambia.



Dr. Jobbicks Kalumba
Permanent Secretary - Technical Services
Ministry of General Education

Acknowledgement

The contribution of STEM Education to national development cannot be over emphasized. Zambia has two dimensional frontiers it can ride on with the STEM agenda; one being that of varied worth of natural resources and the other being land-linked position. Our country is endowed with various resources which need to be well nurtured and also used to benefit its citizens sustainably. The learners at all levels of education require **development of skills and values**. These skills and values are required in order to be productive and ultimately contribute to socio-economic development of the country. The implementation of STEM Education requires sharing the same sense of mission by all stakeholders. To this effect, 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 this STEM Education syllabus.

This STEM Education Syllabus has been aligned with a view to develop Critical, Creative and Analytical Thinkers (CCAT). To do so, the integration of STEM disciplines is highly encouraged as the acquisition of knowledge skills and values through the learning outcomes are expected to be attained by the use of constructivist learning models in which learners take Centre stage while teachers assume the facilitator role. It is therefore, expected that through this STEM Education Syllabus, desirable scientific, ICT literacy and research skills essential in the global economy will be enhanced in learners.

The Ministry of General Education wishes to express heartfelt gratitude to all those who participated in this endeavour for their valuable contributions, which resulted in the development of this syllabus. Therefore, there is need for all stakeholders to work together and see to it that STEM Education strategies are well implemented to yield desirable outcomes. With the implementation of this STEM Education syllabus underway emerging issues may arise and hence, various ideas on STEM Education will continue to be developed and shared for effective implementation. The Ministry of General Education will therefore, endeavour to make available the implementation models as they emerge to keep abreast with STEM Education.

I sincerely thank the Directorate of National Science Centre and the Examinations Council of Zambia for their technical and steadfast support rendered. Further gratitude goes to Provincial Education Officers, District Education Board Secretaries, School Administrators together with staff and other institutions too numerous to mention, for their continued support.



Cecilia N.M Sakala (Mrs.)
Director-Standard and Curriculum
Ministry of General Education

Introduction

This syllabus is driven by provisions of the 1996 National Policy on Education, “Educating Our Future”, and national aspirations which demand that the education system should aim at producing a learner capable of appreciating the relationship between scientific thought, action and technology on the one hand, and sustenance of the quality of life on the other.

Rationale

Computer Science gives learners Vital 21st Century Skills. The Computer Science Syllabus will enhance learners’ abilities to innovate and create new technologies that will drive local and national economies. This ability to innovate with technology is also important for learners’ competences development and their future success to contribute positively in a global society.

General Aims

The aims of Computer Science syllabus are to:

1. Provide quality education through practical engagement
2. Communicate the principles of Computer Science accurately and meaningfully through relating thinking to real life situations

Objectives

The objectives of Computer Science syllabus are to produce a learner who is:

1. Critical, Creative and Analytical Thinker (CCAT)
2. Able to relate thinking with real world situations
3. Problem-solver
4. Responsible citizen

Expected Outcomes

The expected outcomes of this syllabus are learners who are:

1. Critical, Creative and Analytical Thinkers (CCAT)
2. Able to relate thinking with real world situations
3. Problem-solvers
4. Responsible citizens

Structure of the Computer Science Syllabus

The Computer Science syllabus is structured under the headings of Topic, Value, Learning Outcomes, Knowledge and Skills. In this context:

Topic is a broad subject matter encompassing a range of concepts.

Knowledge is the scientific information, concepts, facts that will be acquired through practical experiments and research.

Value is the regard that a concept or topic holds to deserve the importance, worth, significance and usefulness to an individual, society and environment.

Skills are abilities that are acquired to perform particular actions. In Computer Science the skills to be enhanced are Acquisitive, Organizational, Creative, Manipulative and Communicative.

Learning outcomes are specific knowledge, skills and expertise that learners will achieve from a learning activity. In the Computer Science syllabus, the learning outcomes are organised at three levels namely;

1. Demonstration of theoretical understanding of Computer Science concepts, principles
2. Application of theoretical understanding of Computer Science concepts, phenomena, facts, ideas through research, practical, experimental and investigative practice
3. Product design and development based on theoretical understanding of Computer Science concepts phenomena, facts, ideas through research, inventions and innovations

Note: The learning outcomes in this syllabus have been organized in a particular order but this is not intended to suggest a teaching order. Teachers are expected to develop a considerable flexibility in planning and delivery of lessons.

Methodology

The methodologies to be used in the teaching and learning of this Computer Science syllabus are anchored on constructivist learning theories. The tenets for the constructivist learning approach to be undertaken in this syllabus should follow:

1. Problem Presentation [Teacher] (*Situation/*Key question)
2. Hypothesizing [Learners]
3. Designing Solutions [Learners]
4. Presentation of Solutions [Learners]
5. Confirmation of Solutions [Learners & Teacher]

In order for this approach to be effective the teacher and learners have roles to undertake during the teaching and learning process.

Role of a Teacher

In this model teachers will take the role of a **facilitator**. They should incorporate various learning strategies which include:

1. Inquiry Discovery: Learners interact with the environment through exploration and manipulation
2. Problem Based Learning: learning by analyzing relevant facts through problem solving
3. Problem Solving: Learning by solving an open-ended trigger problem
4. Masterly Learning: Evidence based learning in which great time is spent on depth of content

5. Research Approach: Learners assume the role of researchers and go through all the stages of the research process
6. 5 E s Approach: Learning through engagement, exploration, explanations, elaboration and evaluating
7. Subjective Learning: Learning which involves space for learners to present their own ideas, conceptions and misconceptions
8. Experiential Learning: Learning through hands-on experiments
9. Field Work: Learning outside the classroom where learners can explore, discover and experience Physics in everyday life
10. Model Building: Learners designing and constructing a representation of a concept or an object
11. Projects: Learners finding out about a phenomenon over a period of time.

To further emphasize the learning of Computer Science using constructivism, teachers are encouraged not only to familiarize themselves with the scope and sequence of the subject to establish connections of concepts but also incorporate various learning strategies that encourage collaboration such as think, pair and share, peeragogy, and heutagogy to meet the learning styles of learners.

Role of a Learner

The role of learners in this constructivist approach will be to take centre stage in the learning process. For learners to be in charge of their own learning individual peeragogy, heutagogy as well as think, pair and share should be among the learning styles.

Assessment

The types of assessment in this syllabus will be formative and summative. In both types of assessment, the process and product will be given attention with emphasis on skill acquisition.

Summative Assessment

In Computer Science, summative assessment will be administered by the Examinations Council of Zambia (ECZ). Summative assessment in Computer Science shall be at the end of three years and shall be 35% of the total aggregate marks. This will be theory examination single paper with three sections.

Formative Assessment

Formative assessment will comprise of the school-based assessment (SBCA). The School Based Continuous Assessment is 65% of the aggregate scores and will include; tests, assignments, practicals, research, and workbook management.

The scheme of assessment consists of school-based assessment and summative assessment as outlined below:

1.	Assignments	30%
2.	Practical's	20%
3.	Tests	10%
4.	Workbook	5%

Apart from the above stated, Research is also part of Formative assessment and will have an aggregate score of 100 %.

Assignments

Assignments are tasks assigned by teachers to STEM learners for completion outside regular class time on content already done or yet to be done. Learners will be required to do one assignment per Term at this level. There will be no assignment in Term 3 of Grade 12. The total number of assignments will be 8 at senior level. Each assignment will carry 10% marks except for the research-based major assignment which will carry 20% of the 65% allocated for assignments. At the end of grade 12 level the aggregate will be found by dividing the total marks obtained by the number of assignments given as outlined in the assignment score guide.

Grade Level	Type	Assignments				Weight	Aggregate Score	Weight	Overall Score
		Term 1	Term 2	Term 3	Yearly				
10	Major		1		1	20%	$\frac{\text{Score obtained}}{\text{Total score}} \times 20\%$	30%	Major assignment % score + Minor assignment % score
	Minor	1		1	2	10%	$\frac{\text{Sum percentage score}}{\text{Number of assignments}}$		
11	Minor	1	1	1	3				
12	Minor	1	1		2				

Practicals

Practicals are assessment tasks which involve learners working in groups or individually as they observe and manipulate objects to build up understanding of concepts through collection, processing and interpreting data. Practical Work will carry 20 % of the 65 % marks allocated for Continuous Assessment. At the end of the level the aggregate will be found by dividing the total practical scores by the number of practicals undertaken as outlined in the practical score guide.

Grade Level	Practicals			Weight	Aggregate Score
	Term 1	Term 2	Term 3		
10	Score of all practicals	Score of all practicals	Score of all practicals	20%	$\frac{\text{sum percentage practical scores}}{\text{number of practicals}}$
11	Score of all practicals	Score of all practicals	Score of all practicals		or $\frac{\text{sum of practical scores}}{\text{total number of practical scores}} \times 20\%$
12	Score of all practicals	Score of all practicals	Score of all practicals		

Tests

Tests are written tasks with a specified time allocation intended to measure a learner's knowledge and skills. Learners are required to write these tests on hardcopy or softcopy. Some electronic tests will be required to be answered and submitted in real time. The tests will carry 10 % of the 65 % weight allocated for continuous assessment. Learners are required to undertake two tests per term (1 mid and 1 end). There will be no tests in Term 3 of Grade 12. The total number of tests will be 16. Each test will carry 10 % marks. The aggregate test scores will be found by dividing the total test scores by the number of tests as shown in the test score guide below:

Grade Level	Term 1		Term 2		Term 3		Total	Level Total	Weight	Aggregate Score for Test Assessment
10	Mid Term	End Term	Mid term	End Term	Mid Term	End Term	6	16	10%	$\frac{\text{sum percentage score}}{\text{total number of tests}}$ or $\frac{\text{sum test scores}}{\text{total number of scores}} \times 10\%$
11	Mid Term	End Term	Mid term	End Term	Mid term	End Term	6			
12	Mid Term	End Term	Mid term	End Term	No Tests		4			

Research

Research is a sandwich intermediate process in which the theories in STEM Education are transited into evidence-based products closer to prototype status as the learners go through the learning process. Learners will be required to write a research report, defend the research and make a product. The weighting for research is as shown in the following research score guide.

Component	Weight	Total	Aggregate Component Score	Total Score
Research Report	30%	100%	$\frac{\text{Total report score}}{30} \times 30\%$	Total Score = Sum of Report % score + Defence % score + Product % score
Defence (Power Point Presentation)	30%		$\frac{\text{Total defence score}}{30} \times 30\%$	
Research Product	40%		$\frac{\text{Total product score}}{40} \times 40\%$	

Workbook

A Workbook is a learner repository platform in either soft or hard copy format in which learners are expected to have a record of practical assignments, tests, daily reflections and research activities. Learners workbooks will be assessed once at the end of each term and each workbook's assessment will carry 5%. Therefore, at Senior Secondary level, work book assessment will be 9 times. The total aggregate score for workbook assessment at Senior Secondary level will be 5% and this will be obtained by dividing the total workbook scores by 9 terms as shown in the following workbook score guide.

Grade Level	Workbook Assessment			At Each Grade Level	Total workbook assessments	Weight	Total aggregate for Workbook assessment
10	End Term 1	End Term 2	End Term 3	3	9	5%	or $\frac{\text{sum percentage workbook score}}{\text{number of workbook assessments}}$ $\frac{\text{sum of workbook scores}}{\text{total number of workbook assessments}} \times 5\%$
11	End Term 1	End Term 2	End Term 3	3			
12	End Term 1	End Term 2	End Term 3	3			

Summary of Assessment

Type of assessment	Scheme of Assessment	Item Description	Marks Allocation (%)	Total marks Allocated (%)	
Examinations Council of Zambia	Theory	Summative Assessment	35	35%	
School Based	Assignment	Continuous Assessment (Major and Minor)	30	65%	
	Practicals	Continuous Assessment	20		
	Tests	Continuous Assessment	10		
	Work book	Continuous Assessment	5		
	Research	Research Report		30	100%
		Research Defence		30	
		Research Product		40	

Scientific Skills

Category	Skills	Description of skill
1. Acquisitive Acquisitive Skills are the ability to possess and accumulate intrinsic potential for eagerness to input information through sensory channels and proprioception in both passive and active ways in order to process it for making decisions about a situation or concept.	(i) Listening	Ability to accurately receive and interpret messages in the communication process
	(ii) Observing	Ability to use five senses to derive characteristics of objects, events, attitudes and phenomena
	(iii) Searching	Ability to know where to find information - the key texts in your area, the journals, primary sources, etc., and how to get hold of them. Ability to know what information is needed – understanding topic and knowing the key concepts you should research. Knowing how to search the sources - using keywords etc. Ability to record your searches, so that you have an ‘audit trail’
	(iv) Inquiring	Ability to ask questions, and then research, interpret, share, and reflect on answers Ability to apply and use higher order thinking <i>skills</i> like analysis and synthesis <i>Ability to develop</i> curiosity, critical thinking, and independent thinking
	(v) Investigating	Ability to develop active listening, questioning, interviewing, funnelling, summarising and note-taking
	(vi) Gathering data	Ability to effectively collect and curate data for research purposes
	(vii) Researching	Ability to search for, locate, extract, organise, evaluate and use or present information that is relevant to a particular topic
	(viii) Defining operationally	Ability to state how to measure a variable in an experiment
	(ix) Formulating hypotheses	Ability to state the expected outcomes of an experiment

Category	Skills	Description of skill
<p>2. Organisational Organisational Skills are the capacity to manage and stay focused on different tasks by using time, energy, mental strength and physical space effectively through forming structures within which order of doing tasks is clear and co-ordinated to achieve the desired outcomes</p>	(i) Recording	Ability to select and keep useful information, usually focused for a specific purpose
	(ii) Comparing	Ability to find similarities between or among objects, ideas, entities, concepts, events, or other subjects in order to organize both new and known information
	(iii) Contrasting	Ability to find differences between or among objects, ideas, entities, concepts, events, or other subjects in order to organize both new and known information
	(iv) Classifying	Ability to sort, group and arrange events, ideas, concepts and entities based on similarities and differences
	(v) Organising	Ability to create structure and order as well as to efficiently manage time, workload and resources in order to improve productivity and lower stress level
	(vi) Outlining	Ability to list the general features of a research/experiment/event/story in order to shape research/experiment/event/story as intended
	(vii) Reviewing	Ability to learn from experience in order to get more from the work, allowing for flexibility and paying attention to detail
	(viii) Evaluating	Ability to assess the credibility of the claims, and to assess the quality of the reasoning of the arguments or explanations
	(ix) Analysing	Ability to collect and <i>analyse</i> information, problem-solve, and make decisions Ability to develop a logical and rational approach to tackling new ideas, sorting information, and discovering creative solutions
	(x) Predicting	Ability to state the outcome of a future event based on a pattern of evidence
	(x) Inferring	Ability to explain observations and data
(xi) Interpreting data	Ability to organise, conclude from data and make sense of data	

Category	Skills	Description of skill
<p>3. Creative Creative Skills are the ability to perceive and think in an imaginative approach about physical occurrences to enable one to find hidden patterns and make connections among apparently discrete concepts in order to generate novel or unorthodox solutions and come up with something new to address the present and future challenges.</p>	(i) Planning ahead	Ability to develop strategies to accomplish goals Ability to anticipate what is needed to know, to have, and to do, in order to achieve set goals
	(ii) Designing	Ability to think creatively and visualise new ideas, relationships, applications, systems and products in order to develop solutions
	(iii) Inventing	Ability to get new materials or processes by disassembling items in order to manufacture discoverable devices Ability or process of creating or making up something or figuring out a way to do something
	(iv) Synthesizing	Ability to combine parts of a whole in new and different ways by thinking flexibly, determining alternatives, and finding new ways to accomplish a given task
	(v) Formulating models	Ability to create a mental or physical model of a process or event
	(vi) Sketching specimen and science apparatus	Ability to develop visual recall, rendering, and novel visualization of specimen and science apparatus
<p>4. Manipulative Manipulative Skills are the ability to physically interact with the materials or procedures to help in understanding of the underlying principles which might also involve some alterations in order to enhance the performance of equipment and functionality of processes</p>	(i) Using, handling and maintaining instruments	Ability to use, handle and maintain instruments and apparatus appropriately and carefully
	(ii) Demonstrating	Ability to give a practical exhibition and explanation of (how a machine, skill, or craft works or is performed). Ability to clearly show the existence or truth of (something) by giving proof or evidence
	(iii) Experimenting	Ability to test by following procedures to produce verifiable results
	(iv) Constructing	Ability to build or make something or form an idea (scientific) or theory by bringing together various conceptual elements
	(v) Calibrating	Ability to correlate readings of (an instrument) with those of a standard in order to check the instrument's accuracy and to adjust (experimental results) to take external factors into account or to allow comparison with other data

Category	Skills	Description of skill
	(vi) Measuring and using numbers	Ability to use standard and non-standard measures to describe dimensions
	(vii) Controlling variables	Ability to identify variables, keep variables constant and manipulate variables
	(viii) Handling specimen and chemicals correctly and carefully	Ability to handle and maintain specimen and chemicals appropriately and carefully
5. Communicative Communicative Skills are the ability to effectively inquire and engage others, to obtain or disseminate vital information, coherently and clearly through the use of mutually understood symbols, signs and semiotic rules in order to make sense of what is intended.	(i) Questioning	Ability to ask appropriate and relevant questions in order to obtain information, clarify a point, test knowledge or encourage further thought
	(ii) Discussing	Ability to state an opinion confidently and ask for others' opinions Ability to argue constructively, offer suggestions and express uncertainty
	(iii) Explaining	Ability to present the subject matter in a simplified form and making it acquirable Ability to use verbal and non-verbal cues at appropriate times in a discussion to show understanding by describing logically 'how', 'why' and 'when' concept
	(iv) Reporting	Ability to provide status information, detailed descriptions of the tasks or communication to show presence
	(v) Writing	Ability to put feelings and ideas on paper, to organize knowledge and beliefs into convincing arguments, and to convey meaning through well-constructed text
	(vi) Criticising	Ability to judge the merits and faults of something Ability to provide constructive arguments for improvement, and being able to withstand the pressure of unfair or dispiriting criticisms while motivating oneself to work harder and better instead of giving up
	(vii) Graphing	Ability to read, construct, analyse and interpret graphs and graphical information in order to visually communicate information
	(viii) Teaching	Ability to use appropriate pedagogy and didactics in order to facilitate learning and communication
	(ix) Communicating	Ability to use words or symbols to describe an action, object or event

Grade 10 Computer Science

General Outcomes	Key Competences
<ol style="list-style-type: none">1. Demonstrate theoretical understanding of Computer Science, System Architecture, Data Representation, Logic gates, Computer system Maintenance and repair2. Apply the theoretical understanding of Computer Science, System Architecture, Data Representation, Logic gates, Computer system Maintenance and repair3. Design and develop products based on the theoretical understanding of Computer Science, System Architecture, Data Representation, Logic gates, Computer system Maintenance and repair	<p>Demonstrate Scientific skills such as:</p> <ul style="list-style-type: none">• Acquisitive• Organizational• Creative• Manipulative• Communicative

Grade 10 Computer Science Syllabus Content

Topic	Value: <i>Humanity has always looked for innovations to help ease out its activities in the quest to improve the wellbeing of all living organisms and their environment. One such innovative creation is the computer with capabilities to handle present and future challenges and advancements across various fields ranging from agriculture, manufacturing, space and deep-sea explorations, communication and education among others. Knowledge of computers and the learning environment will accord learners unlimited opportunities to understand computers more and be able to manipulate them through interactions with institutions, government departments and organizations as their learning environments.</i>			
	Sub-topic	Learning Outcome	Content	
			Knowledge	Skill
10.1 Computer Science	10.1.1 Learning Environment	10.1.1 Demonstrate theoretical understanding of the Computer Science Learning environment	Theories of Computer Science learning environment such as: <ul style="list-style-type: none"> • Computer systems (laptops, desk tops, phones) • Computer laboratory infrastructure • Networked (intranet and internet) institutions, departments and organizations 	Acquisitive Organizational Communicative
		10.1.2 Apply theoretical understanding of the Computer Science learning environment	Application of theoretical understanding of Computer Science Learning environment such as; <ul style="list-style-type: none"> • Connecting and disconnecting various computer system peripherals • Care and maintenance of computer systems and peripherals • Safety precautions in handling computer systems and peripherals 	Organizational Manipulative Communicative
		10.1.3 Design and develop models depicting Computer Science learning environment	Design and create conceptual models depicting the Computer Science learning environment	Organizational Creative Manipulative Communicative

Topic	Value: <i>The backbone of any computer system is based on the architectural interaction of its software and hardware. The understanding of the art of computer Systems design, Instruction Set and Micro architecture of a computer helps the learners to sustainably design and develop applications as demanded by society and its development.</i>			
	Sub-topic	Learning Outcome	Content	
			Knowledge	Skills
10.2 Computer Architecture	10.2.1 System Design, Instruction Set and Micro architecture	10.2.1.1 Demonstrate theoretical understanding of System Design, Instruction Set and Micro architecture	Theories of the CPU such as; <ul style="list-style-type: none"> • Concepts of Von Neumann architecture's components ((MAR, MBR), CIR, APC) • Common CPU components and their functions (ALU, CU, Registers) • Embedded systems (Primary and Secondary memories, Capacity, Speed, Volatility) • Data transfer methods (DMA) and Programmed Interrupt-initiated Input and Output 	Acquisitive Organizational Communicative
		10.2.1.2 Apply theoretical understanding of CPU, Memory and Input and Output interfaces through practical	Application of theories of the computer system architecture such as: <ul style="list-style-type: none"> • Enhanced CPU performance • Extended Memory of Computer 	Organizational Manipulative Communicative
		10.2.1.3 Design models that demonstrate how the different components of the Central Processing Unit (CPU) operate.	Product development such as: <ul style="list-style-type: none"> • CPU Design simulating the working principle of a CPU (using different types of software) • Make a Prototype CPU using Logic ICs 	Organizational Creative Manipulative Communicative

Topic	Value: All software, music, documents, strings, integers, characters, colours and any other information that is processed by a computer are stored using binary numbers 0 and 1. Binary data take a lot of memory and processing time. Therefore, understanding data representation helps to develop better ways of overcoming this limitation and handling long streams of binary digits, including the use of higher number systems such as hexadecimal numbers. This helps to improve the processing speed and optimize memory usage.			
	Sub-topic	Learning Outcome	Content	
			Knowledge	Skills
10.3 Data Representation	10.3.1 Number System Conversion, Boolean algebra and Logic gates	10.3.1.1 Demonstrate theoretical understanding of number system Conversion. Boolean algebra and Logic gates	Theories and Concepts of computer arithmetic such as: <ul style="list-style-type: none"> • Decimal base, Binary base, Octal base, Hexadecimal base • Number System Conversion • Binary Arithmetic • Converting from one number system to another • Uses of binary and hexadecimal number system in Computer Systems • Boolean algebra (De Morgan's law, Commutative Associative and Distributive - CAD laws) 	Acquisitive Organizational Communicative
		10.3.1.2 Apply theoretical understanding of concepts of number system Conversion, Boolean algebra	Application of theories of number system conversion and Boolean algebra such as: <ul style="list-style-type: none"> • Simplifying Logic Circuits diagrams using De Morgan's Law 	Organizational Manipulative Communicative
		10.3.1.3 Design products based on theoretical understanding of concepts of number system Conversion, Boolean algebra and Logic gates	Product design and development such as: <ul style="list-style-type: none"> • Building a keyboard that converts decimal to binary numbers • Creating a Logic Gate Circuit to implement the conversion from one number system to another 	Organizational Creative Manipulative Communicative

Topic	Value: Logic gates help learners to have an understanding of the building blocks of digital integrated circuits. Furthermore, they help learners to learn to think logically and develop an analytical, problem-solving mind-set. Learning Logic gates enables learners to pay attention to detail and have a focus on what they are learning. Building logic gates develops critical thinking skills as they discover and understand how computers as logical machines work and how they can be created. Logical thinking and problem-solving abilities will help enhance peace in communities.			
	Sub-topic	Learning Outcome	Content	
			Knowledge	Skills
10.4 Logic Gates	10.4.1 Logic gate types and functions	10.4.1.1 Demonstrate theoretical understanding of Logic gates	Theories of Logic gates such as: <ul style="list-style-type: none"> • Boolean Algebra • Logic simplification • Combinational circuits • Logic ICs 	Acquisitive Organizational Communicative
		10.4.1.2 Apply theoretical understanding of the three Basic Logic gates	<ul style="list-style-type: none"> • Application of theories of basic understanding of three logic gates such as: • Designing Adders, Comparators, Encoder/Decoders, Mux/DeMux, BCD-to-7-Segment decoder) • Sequential circuits • Latches • Flip-Flops • Asynchronous and Synchronous counters • Setup and map pin outs for IC 7404(NOT), IC7400 (NAND), IC7408 (AND), IC7432 (OR) 	Organizational Manipulative Communicative
		10.4.1.3 Design and develop products based on the theoretical understanding of the three basic Logic gates	<ul style="list-style-type: none"> • Design and development of products such as: • Half adder and full adder • Counters, Flip-flops, Astable and Bistable Circuits (<i>car indicators, Clock</i>) • Multiplexer and De-Multiplexer • Programme a Microcontroller (such as Arduinos, Raspberry PI) • Build a simple computer 	Organizational Creative Manipulative Communicative

Topic	Value: Computer system maintenance and repair will help learners to be able to diagnose and repair faulty hardware and software; install software; evaluate, detect, and troubleshoot different types of issues affecting computer systems. Additionally, through deconstruction, Computer System Maintenance enables learners to have analytical, problem-solving and communication skills. Furthermore, it provides a platform for innovation and entrepreneurship.			
	Sub-topic	Learning Outcome	Content	
			Knowledge	Skills
10.5 Computer System Maintenance and repair	10.5.1 Hardware and Software troubleshooting and repair	10.5.1.1 Demonstrate theoretical understanding of Hardware, Operating System and Utility Software, troubleshooting and repair	Theories of Computer System maintenance and repair such as: <ul style="list-style-type: none"> • Hardware components (all) • Different Software purposes and installations • Hardware and Software troubleshooting • Hard drive partitioning • Use of DOS commands to create and change directories 	Acquisitive Organizational Communicative
		10.5.1.2 Apply theoretical understanding of Hardware and Software troubleshooting and repair through practical	Application of theories of Computer system Maintenance and repair such as: <ul style="list-style-type: none"> • Hardware and Software troubleshooting, assemble and repair • Compare different generations of processors • Analyzing common symptoms and problems associated with PC components • Resolve issues, such as problems with screens, network cards, and motherboards, video cards, sound cards, and software issues relating to productivity tools • Practice use of DOS commands 	Organizational Manipulative Communicative
		10.5.1.3 Design products based on theoretical understanding on Hardware and Software troubleshooting and repair	Design and develop Products such as: <ul style="list-style-type: none"> • Functional Computer • Upgrading Software • Downloading and uploading software • Alerting Software 	Organizational Creative Manipulative Communicative

Grade 11 Computer Science

General Outcomes	Key Competences
<ol style="list-style-type: none">1. Demonstrate theoretical understanding of programming and databases2. Apply the theoretical understanding of programming and databases3. Design and develop products based on the theoretical understanding of programming and databases	<p>Demonstrate Scientific skills such as:</p> <ul style="list-style-type: none">• Acquisitive• Organizational• Creative• Manipulative• Communicative

Grade 11 Computer Science Syllabus Content

Topic	Value: <i>Programming is the process of designing and developing an executable computer software package to accomplish a specific result. Additionally, programming reinforces logic thereby enabling learners to thinking rationally about processes in the world. It teaches learners a number of life lessons such as learning from mistakes, handling failure, persistence and teamwork. Moreover, programming also gives learners a skill set that can be used to become an innovator and entrepreneur. Most jobs in Mathematics and Science are becoming computing jobs and more opportunities in the technology industry are emerging as Internet of Things (IoT) and Robotics are reshaping the jobs of tomorrow. Programming knowledge can also change the way we interact with the technologies such as smartphones, laptops, social media networks, and video gaming.</i>			
	Sub-topic	Specific Outcome	Content	
			Knowledge	Skill
11.1 Programming	11.1.1 Web Design & Programming	11.1.1.1 Demonstrate theoretical understanding of Web Design and Programming	Theories of programming techniques such as: <ul style="list-style-type: none"> • Structure of HTML Tags, attributes, elements • Documents structure (header, body, footer tags) • Web Page (pictures, videos, tables, links) • Forms • Formatting Text, background, • Structure of CSS, syntax • JavaScript. • Variables (Int, strings and arrays) • Basic Input and Output • Math operators • Logical operators • Arrays (initialization, declaration) 	Acquisitive Organizational Manipulative Communicative
		11.1.1.2 Apply theoretical understanding of programming techniques through practical	Application of theories of Web Design and Programming to create: <ul style="list-style-type: none"> • Fully functioning web page. • Fully functioning JavaScript based applications (calculators, text manipulation, clock, timer, games, quizzes, Workbook, budgeting application, words filtering, 	Organizational Manipulative Communicative

Topic	Value: <i>Programming is the process of designing and developing an executable computer software package to accomplish a specific result. Additionally, programming reinforces logic thereby enabling learners to thinking rationally about processes in the world. It teaches learners a number of life lessons such as learning from mistakes, handling failure, persistence and teamwork. Moreover, programming also gives learners a skill set that can be used to become an innovator and entrepreneur. Most jobs in Mathematics and Science are becoming computing jobs and more opportunities in the technology industry are emerging as Internet of Things (IoT) and Robotics are reshaping the jobs of tomorrow. Programming knowledge can also change the way we interact with the technologies such as smartphones, laptops, social media networks, and video gaming.</i>		
	Sub-topic	Specific Outcome	Content
			Knowledge
		11.1.1.3 Design a product based on the theoretical understanding of programming techniques	<ul style="list-style-type: none"> • Product development such as: • Basic HTML5 Web Page • Peer-to-Peer Messaging Application • Learning Management System • Language Translation • Application such as Payment System, Online Game Application • Convertor Applications (currency, number)
11.1.2. Programming in Python	11.1.2.1 Demonstrate theoretical understanding of programming techniques in Python	Theories of programming techniques such as: <ul style="list-style-type: none"> • Programming Languages (Python) • Programming Environment (code block) • Strings <ul style="list-style-type: none"> ○ Variables (types, declaration) ○ Basic Input and Output ○ Math and logical operators ○ Control Structures(loops) ○ Functions ○ Exception Handling ○ Parameters ○ Return values ○ Lists ○ Arrays (declaration and initialization) 	Acquisitive Organizational Communicative

Topic	Value: <i>Programming is the process of designing and developing an executable computer software package to accomplish a specific result. Additionally, programming reinforces logic thereby enabling learners to thinking rationally about processes in the world. It teaches learners a number of life lessons such as learning from mistakes, handling failure, persistence and teamwork. Moreover, programming also gives learners a skill set that can be used to become an innovator and entrepreneur. Most jobs in Mathematics and Science are becoming computing jobs and more opportunities in the technology industry are emerging as Internet of Things (IoT) and Robotics are reshaping the jobs of tomorrow. Programming knowledge can also change the way we interact with the technologies such as smartphones, laptops, social media networks, and video gaming.</i>		
Sub-topic	Specific Outcome	Content	
		Knowledge	Skill
	11.1.2.2 Apply theoretical understanding of programming techniques through practice	<ul style="list-style-type: none"> ○ Dictionary ○ File handling ○ Classes and objects ○ Data Structures ● Debugger 	
		Application of theories of Computer Programming In designing solutions in fields of: <ul style="list-style-type: none"> ● Science (Write code such as Motion of Particles simulator, DNA sequencing, Chemical reaction solver) ● Engineering (3D modelling software, Artificial Intelligence, Machine Learning) ● Technology (Programming Arduinos for a Computer Numerical Control Machine, Creating and uploading a sketch for Arduinos, Smart Grid program, ● Mathematics (Prime Number Generator, Trigonometry Solver, Fibonacci sequence, Compound interest calculator) 	Organizational Manipulative Communicative

Topic	Value: <i>Programming is the process of designing and developing an executable computer software package to accomplish a specific result. Additionally, programming reinforces logic thereby enabling learners to thinking rationally about processes in the world. It teaches learners a number of life lessons such as learning from mistakes, handling failure, persistence and teamwork. Moreover, programming also gives learners a skill set that can be used to become an innovator and entrepreneur. Most jobs in Mathematics and Science are becoming computing jobs and more opportunities in the technology industry are emerging as Internet of Things (IoT) and Robotics are reshaping the jobs of tomorrow. Programming knowledge can also change the way we interact with the technologies such as smartphones, laptops, social media networks, and video gaming.</i>		
Sub-topic	Specific Outcome	Content	
		Knowledge	Skill
	11.1.2.3 Design and create products based on the theoretical understanding of programming techniques	Product design and development such as: <ul style="list-style-type: none"> • Applications (Text manipulating software, text analysis, sound analysis, sentiment analysis) • Computer Numeric Control • Router • Robots • Payment System • Video Calling • Programming language • Gaming Applications 	Organizational Creative Manipulative Communicative
11.1.3 Mobile phone application Development Using Android Programming	11.1.3.1 Demonstrate theoretical understanding of Android Technology including its Operating System	Outline Android Technologies, its architecture and features such as: <ul style="list-style-type: none"> • Android Operating System layers, Linux Kernel, Libraries, Android Runtime, and Application Framework. • Installing Android Machine software (setting up development Environments such as eclipse, Android Studio) • Simulate android device on Android Emulator • User Interface Widgets <ul style="list-style-type: none"> ○ Button, Toast, Alert Dialog, Spinner, Date Picker, Progress Bar, Activity, Intent & 	Acquisitive Organizational Communicative

Topic	Value: <i>Programming is the process of designing and developing an executable computer software package to accomplish a specific result. Additionally, programming reinforces logic thereby enabling learners to thinking rationally about processes in the world. It teaches learners a number of life lessons such as learning from mistakes, handling failure, persistence and teamwork. Moreover, programming also gives learners a skill set that can be used to become an innovator and entrepreneur. Most jobs in Mathematics and Science are becoming computing jobs and more opportunities in the technology industry are emerging as Internet of Things (IoT) and Robotics are reshaping the jobs of tomorrow. Programming knowledge can also change the way we interact with the technologies such as smartphones, laptops, social media networks, and video gaming.</i>		
Sub-topic	Specific Outcome	Content	
		Knowledge	Skill
	11.1.3.2 Apply theoretical understanding of Android Development	<ul style="list-style-type: none"> Fragment <ul style="list-style-type: none"> ○ Android Menu, Views, Toast, Dialog, List & Adapters and File Download ○ Activity Lifecycle, Fragment Lifecycle ○ Option, Context and Popup menu Text View and WebView • Data Storage (Manage Android File System Internal storage, External storage Create SQLite database in android, Opening and closing a database) • Programming Interface (Writing code to perform Inserts, updates, and deletes) • Multimedia (Wallpaper, Audio and Player, Video, Gallery) • Phone Application (SMS, Call, e-mail) 	
		Application of Android Technologies and architecture such as: <ul style="list-style-type: none"> • Installing development Environment for Android Development. • Installing Android Emulator • Designing Button, Toast, Alert Dialog, Spinner, Date Picker, Progress Bar and File 	Organizational Manipulative Communicative

Topic	Value: <i>Programming is the process of designing and developing an executable computer software package to accomplish a specific result. Additionally, programming reinforces logic thereby enabling learners to thinking rationally about processes in the world. It teaches learners a number of life lessons such as learning from mistakes, handling failure, persistence and teamwork. Moreover, programming also gives learners a skill set that can be used to become an innovator and entrepreneur. Most jobs in Mathematics and Science are becoming computing jobs and more opportunities in the technology industry are emerging as Internet of Things (IoT) and Robotics are reshaping the jobs of tomorrow. Programming knowledge can also change the way we interact with the technologies such as smartphones, laptops, social media networks, and video gaming.</i>			
	Sub-topic	Specific Outcome	Content	
			Knowledge	Skill
			Download <ul style="list-style-type: none"> • Creating android Activity • Creating a Graphical User Interface containing Text View, WebView Options, Contexts and Popup menu. • Creating an Android File management System for Internal storage and External storage • Creating SQLite database, create Tables • Opening and closing a database Inserts, updates, and deletes • Creating Multimedia contents (Wallpaper, Audio, and Video) • Playing Audio, playing Video and creating Gallery • Making Android Application for calling, sending SMS and e-mail 	
	11.1.3.3 Design Android Application and products based on theoretical understanding of Android Development	Design and produce Android applications that may include among others: <ul style="list-style-type: none"> • Travel guide, Dictionary, Mobile Banking, Video Chatting, Texting, Weather, Education, Hospital Database, Library applications • Digital Thermometer 	Organizational Creative Manipulative Communicative	

Topic	Value: Database systems, being organised information stored in a certain form, are very important as they help to systematise various transactions in all spheres of life. Knowledge and conceptual understanding of the database systems will equip learners to be able to create databases and track activities at individual level as well as at different levels in their lives. Learning database systems will also help learners to effectively use statistical packages to resolve issues to do with statistics. Extension of the learner's competences will also be beneficial to any organization or department that they will get attached to in society thereby bringing order and effectiveness in resolving multiple issues.			
	Sub-topic	Learning Outcome	Content	
			Knowledge	Skills
11.2 Databases	11.2.1. Database Management system, Database Security and Structured Query Language (SQL) Queries	11.2.1.1. Demonstrate theoretical understanding of Database Management System, database Security and Structured Query Language (SQL) Queries	<p>Theories of Database Management System, Database Security and Structured Query Language (SQL) Queries such as:</p> <ul style="list-style-type: none"> • Database design (Entity Relation Diagrams and Relational database modals) • Using SQL on the data bases to do the following: <ul style="list-style-type: none"> ○ Create and Drop a table ○ CREATE, READ, UPDATE, DELETE and Validate tuples (CRUD) ○ Create a primary key and foreign Keys ○ Formulate SQL expression using Query Statement (SELECT, INSERT, DELETE) ○ A condition (where ○ Junction Aggregation (avg, count, min, max and sum.) ○ Join ○ Reinforce the integrity ○ Create views ○ Query on a table ○ Query on multiple tables ○ Nested Queries • Database Security Implementation (Integrity and 	<p>Acquisitive Organizational Manipulative Communicative</p>

Topic	<p>Value: Database systems, being organised information stored in a certain form, are very important as they help to systematise various transactions in all spheres of life. Knowledge and conceptual understanding of the database systems will equip learners to be able to create databases and track activities at individual level as well as at different levels in their lives. Learning database systems will also help learners to effectively use statistical packages to resolve issues to do with statistics. Extension of the learner's competences will also be beneficial to any organization or department that they will get attached to in society thereby bringing order and effectiveness in resolving multiple issues.</p>			
	Sub-topic	Learning Outcome	Content	
			Knowledge	Skills
			Privacy, Availability, Command GRANT and REVOKES, Backup) <ul style="list-style-type: none"> Data Management and Administration including, Concept of transaction, Concurrent access, Remote access 	
	11.2.1.2. Apply theoretical understanding of Database Management System, database Security and Structured Query Language (SQL) Queries	Application of theories of Database Management System, Database Security and Structured Query Language (SQL) on Queries such as: <ul style="list-style-type: none"> Design Database and create required tables such as Bank, College/University, Hospital, Airport, Farm database. Keys, not NULL to the tables Application of the constraints like primary keys, foreign Keys Creation of database Management System Writing SQL statements for implementing ALTER, UPDATE, DELETE Writing query for implementing average, count, minimum, maximum and summation) Formulating SQL expression using Query Statement (SELECT, INSERT, DELETE) Formulate SQL Queries on Database Security. 	Organizational Manipulative Communicative	

Topic	Value: <i>Database systems, being organised information stored in a certain form, are very important as they help to systematise various transactions in all spheres of life. Knowledge and conceptual understanding of the database systems will equip learners to be able to create databases and track activities at individual level as well as at different levels in their lives. Learning database systems will also help learners to effectively use statistical packages to resolve issues to do with statistics. Extension of the learner's competences will also be beneficial to any organization or department that they will get attached to in society thereby bringing order and effectiveness in resolving multiple issues.</i>			
	Sub-topic	Learning Outcome	Content	
			Knowledge	Skills
		11.2.1.3. Design products based on the theoretical understanding of Database Management System, Database Security and Structured Query Language (SQL) Queries	Products developed such as: <ul style="list-style-type: none"> • Formulating different SQL Query Expressions • Database Security Queries • Database Management Systems 	Organizational Creative Manipulative Communicative

Grade 12 Computer Science

General Outcomes	Key Competences
<ol style="list-style-type: none">1. Demonstrate theoretical understanding of Networking, Computer Security, Fundamentals of Robotics & Automation and Mobile Phone Application Development2. Apply the theoretical understanding of Networking, Computer Security, Fundamentals of Robotics & Automation and Mobile Phone Application Development3. Design and develop products based on the theoretical understanding of Networking, Computer Security, Fundamentals of Robotics & Automation and Mobile Phone Application Development	<p>Demonstrate Scientific skills such as:</p> <ul style="list-style-type: none">• Acquisitive• Organizational• Creative• Manipulative• Communicative

Grade 12 Computer Science Syllabus Content

Topic	Value: Information exchange enhances the wellbeing of human interactions across many spheres. Networking enables people in different places near and far to share vital data on various convenient platforms in order to improve quality of life. The concepts of networking will give learners the opportunities to both share data and be able to develop systems which will foster not only accessibility but efficiency within their communities and wider areas where people and other living creatures may be found.			
	Sub-topic	Learning Outcome	Content	
			Knowledge	Skills
12.1 Networking	12.1.1 IP addressing, common protocols, Installation and Configuration of Computer Networks	12.1.1.1 Demonstrate theoretical understanding of IP addressing, common protocols, Installation and Configuration of Computer Networks.	<p>Theories of Networking such as:</p> <ul style="list-style-type: none"> • Types of networks (Personal Area Network, Local Area Network, Wireless Local Area Network, Campus Area Network, Metropolitan Area Network -, Wide Area Network • Network Topologies • IP addressing Components (Default Subnet and Non-default Masks, Parts of an IP address - network part and the host part, TCP/IP, Subnet mask, Network classes, Sub-netting, Default gateways, Relationship between IP and DNS) • Transmission median <ul style="list-style-type: none"> ○ Guided median (UTP/STP cable, Coaxial cable, Fibre optic cable ○ Unguided Median (Infrared, Bluetooth) • Network devices components Hub, Switch, Router, Bridge, Gateway, Modem, Repeater, Access Point, Cable tester, RJ 45 connectors) • Installation and Configurations (Cross over and straight cable, File and Printer sharing, Modem installation, IP addresses and Network and security • Hardware and software system security (Protection against hardware theft and abuse, malware/spyware and unauthorized use of systems and components, including firewall and intrusion detection system (IDS) maintenance 	<p>Acquisitive Organizational Manipulative Communicative</p>

Topic	Value: <i>Information exchange enhances the wellbeing of human interactions across many spheres. Networking enables people in different places near and far to share vital data on various convenient platforms in order to improve quality of life. The concepts of networking will give learners the opportunities to both share data and be able to develop systems which will foster not only accessibility but efficiency within their communities and wider areas where people and other living creatures may be found.</i>		
	Sub-topic	Learning Outcome	Content
			Knowledge
12.1.1.2. Apply theoretical understanding of IP addressing, common protocols, Installation and Configuration of Computer Networks through practical	Application of theories of Networking such as: <ul style="list-style-type: none"> • Configuring and assigning IP addresses on a network • Sub-netting IP addresses • Remote Desktop • Installing, maintaining and troubleshooting servers • Making cross and straight network cables • Make a cable UTP/STP 	Organizational Manipulative Communicative	
12.1.1.3. Design and develop a model that demonstrates how IP addressing, common protocols, Installation and Configuration of Computer Networks operate	Product development such as: <ul style="list-style-type: none"> • Network for business applications • Decentralised Disruption Tolerant Network • IP based monitoring system • Web Security System • Network Systems (Smart Grid, Smart Water Distribution, Smart Street Lighting, Smart Irrigation Weather Monitoring) 	Organizational Creative Manipulative Communicative	

Topic	Value: Humans and machines exchange a lot of information across vast space and networks in different fields of endeavours for operations and decision making within specified confines. Computer security enables learners to understanding digital citizenship and the responsible use of computer systems and mobile phones. Further, the knowledge acquired can be used to keep confidential information and maintain data integrity on the system in order to protect them from scams and frauds when they are interacting in the cyber space.			
	Sub-topic	Learning Outcome	Content	
			Knowledge	Skills
12.2 Computer Security	12.2.1 Software, web and Mobile Phone Security	12.2.1.1 Demonstrate theoretical understanding of Software, Web and Mobile Phone Security	<p>Theories of Computer Security such as:</p> <ul style="list-style-type: none"> • Firewalls, Software Security • Threats, vulnerabilities, (prevention, detection, deterrence) • (Passwords security policies) • Ethical issues (copyright issues, plagiarism hacking, cracking and production of malware) • Free software, freeware and shareware • Concepts of Cryptography • Web Security <ul style="list-style-type: none"> ○ Vulnerabilities, Attacks, and Countermeasures ○ Same Origin Policy ○ Cross-Site Scripting Request and Forgery Attack ○ Cross-Site Attack ○ SQL-Injection Attack ○ Click-Jacking Attack ○ Web Tracking ○ Web Proxy and Firewall • Smartphone Security <ul style="list-style-type: none"> ○ Access control in Android operating system ○ Rooting Android devices ○ Attacks on apps ○ Hardware protection: Trust Zone • Digital signatures and message digests for data authentication. 	Acquisitive Organizational Communicative

Topic	Value: <i>Humans and machines exchange a lot of information across vast space and networks in different fields of endeavours for operations and decision making within specified confines. Computer security enables learners to understanding digital citizenship and the responsible use of computer systems and mobile phones. Further, the knowledge acquired can be used to keep confidential information and maintain data integrity on the system in order to protect them from scams and frauds when they are interacting in the cyber space.</i>		
	Sub-topic	Learning Outcome	Content
			Knowledge
12.2.1.2 Apply theoretical understanding of Computer Security through practical	<ul style="list-style-type: none"> • Application of theories of Computer Security such as: • Install Firewalls and anti-virus software on computer systems • Scan for threats and vulnerabilities • Create and implement Passwords security policies • Outline and apply Ethical and Legal issues (copyright issues, plagiarism hacking, cracking and production of malware) • Explore different types of license agreements regarding Free software, freeware and shareware • Detect and prevent threats and vulnerabilities, Implement Hashing algorithms such as SHA1 and MD5 to maintain data integrity, Encrypt and Decrypt algorithms such as RSA using Private and public-keys • Identify and Detect Web Security, Vulnerabilities, Attacks, and devise Countermeasures • Classify Security risk of Rooted Smartphones and reduce digital footprints in the use of Mobile Phones 	<ul style="list-style-type: none"> Organizational Manipulative Communicative 	
12.2.1.3 Design products based on the theoretical understanding of Computer Security	<ul style="list-style-type: none"> • Product design and development such as: • Anti-virus software and Password Manager • Backup and data recovery applications • Mobile Phone flushing applications • Reverse engineered virus • Banking Security System • Key loggers 	<ul style="list-style-type: none"> Organizational Creative Manipulative Communicative 	

Topic	Value: Robotics is an interdisciplinary subject that brings together Electrical Engineering, Mechanical Engineering, Computer Programming, Mathematics and Technology. It enables learners to understand how robots operate in real world situations. Learning robotics will give learners the opportunity to build, test, and modify robots familiar with any Programming languages and microcontroller. These proficiencies will help popularize the use of robot-aided activities in our societies for improved productivity and service deliveries.			
	Sub-topic	Learning Outcome	Content	
			Knowledge	Skills
12.3. Fundamentals of Robotics and Automation	12.3.1 Robotics and Automation	12.3.1.1. Demonstrate theoretical understanding of Robotics and automation	<p>Theories of Classification of Robots, Robot architecture and Components, Robot Characteristics, Ethics in Robotics such as:</p> <ul style="list-style-type: none"> Understanding types, classification and characteristics of sensors (Position Sensors, Velocity Sensors, Acceleration Sensors, Touch and Tactile Sensors, Proximity Sensors, Range Finder, magnetometers, gyroscopes, Light Sensor, Temperature Sensor, Vibration Sensor, Ultrasonic Distance Sensor, Geographic Positioning System) Actuating Systems, Hydraulic, Pneumatics, Electric Motors - Servos, Steeper motors, Solenoids, Gears to Create Robot Mechanisms Control algorithms, flowcharts and Pseudo codes for a given task Microcontroller Autonomous Robots (Perception, Decision making and Actuation) Elements of Automated Manufacturing System 	<p>Acquisitive Organizational Manipulative Communicative</p>
		12.3.1.2 Apply theoretical understanding of Robotics and automation to tackle Engineering, Manufacturing and Distribution challenges	<p>Application of theories of Robotics and automation in actions and processes such as:</p> <ul style="list-style-type: none"> Ultrasonic Distance Calculations, Velocity, Acceleration Sensing, Touch and Tactile Sensing Obstacle detection and avoidance - Proximity Sensing, Range Finding, Light guided Robot (Light Sensor) Temperature Sensing, Vibration Sensing, Humidity Sensing 	<p>Organizational Manipulative Communicative</p>

Topic	Value: Robotics is an interdisciplinary subject that brings together Electrical Engineering, Mechanical Engineering, Computer Programming, Mathematics and Technology. It enables learners to understand how robots operate in real world situations. Learning robotics will give learners the opportunity to build, test, and modify robots familiar with any Programming languages and microcontroller. These proficiencies will help popularize the use of robot-aided activities in our societies for improved productivity and service deliveries.			
	Sub-topic	Learning Outcome	Content	
			Knowledge	Skills
		12.3.1.3 Design products based on theoretical understanding of Robotics and Automation	Product design and developed such as; <ul style="list-style-type: none"> Automated Industrial, Manufacturing (packaging, testing, assembling, labelling, distribution) Drones, autonomous Tractors A CNC Machine to solve a specific engineering problem 	Organizational Creative Manipulative Communicative

Scope and Sequence

Grade 10		Grade 11		Grade 12	
Topic	Sub-Topic	Topic	Sub-Topic	Topic	Sub-Topic
10.1 Computer Science	10.1.1 Learning Environment	11.1 Programming	11.1.1 Web Design & Programming	12.1 Networking	12.1.1 IP addressing, common protocols, Installation and Configuration of Computer Networks
			11.1.2. Programming in Python		
			11.1.3 Mobile phone application Development Using Android Programming		
10.2 Computer Architecture	10.2.1 System Design, Instruction Set and Micro architecture	11.2 Databases	11.2.1. Database Management system, Database Security and Structured Query Language (SQL) Queries	12.2 Computer Security	12.2.1 Software, web and Mobile Phone Security
10.3 Data Representation	10.3.1 Number System Conversion, Boolean algebra and Logic gates	11.3 Programming in Python	11.3.1. Programming techniques	12.3. Fundamentals of Robotics and Automation	12.3.1 Robotics and Automation
10.4 Logic Gates	10.4.1 Logic gate types and functions	11.4 Computer Security	11.4.1 Software, web and Mobile Phone Security		

Time Allocation

There will be eight (8) periods of forty minutes each. This translates into **320 minutes per week**.