basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

PROPOSED AMENDMENTS TO THE CURRICULUM AND ASSESSMENT POLICY STATEMENT (CAPS) TO MAKE PROVISION FOR CODING AND ROBOTICS GRADES R- 9

Curriculum and Assessment Policy Statement

Grades 7- 9

CODING AND ROBOTICS

FOREWORD BY THE MINISTER

In the last twenty-five years, our National Curriculum Statement (NCS) has been focused on transforming Education in South Africa. The democratic values enshrined in our Constitution (Act 108 of 1996) have inspired the development the National Curriculum. The Preamble to the Constitution states that the aims of the Constitution are to:

heal the divisions of the past and establish a society based on democratic values, social justice and fundamental human rights;

improve the quality of life of all citizens and free the potential of each person;
lay the foundations for a democratic and open society in which government is based on the will of the people and every citizen is equally protected by law; and

build a united and democratic South Africa able to take its rightful place as a sovereign state in the family of nations.

Education and the Curriculum have an important role to play in realising these aims. In 1997 Outcomes Based Education was introduced to overcome the Curricular divisions of the past and was reviewed in 2000. This led to the first Curriculum revision: The Revised National Curriculum Statement Grades R-9 and the National Curriculum Statement Grades 10-12 (2002).

In 2009 the Revised National Curriculum Statement (2002) was revised due to implementation challenges. The National Curriculum Statement Grade R-12 was developed in 2012 which combined the 2002 Curricula for Grade R-9 and Grades 10-12. The National Curriculum Statement for Grades R-12 builds on the previous curriculum but also updates it and aims to provide clearer specification of what is to be taught and learnt on a term-by-term basis.

The Curriculum has been developed encompassing the vision of the National Development Plan (NDP) aligning the Skills, Knowledge and Values required for the Technological Developments in the workplace. The NDP goals are aligned to the Sustainable Development Goals (SDG) and the African Union Agenda 2063. The Modern workplace requires learners that can adapt to a fast-changing home and work environments through empowering learners with the skills they develop through the Three Stream Model. These goals will be achieved through Differentiated Pathways and Multi-Certification levels.

The National Curriculum Statement Grades R-12 accordingly replaces the Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines with the

(a) Curriculum and Assessment Policy Statements (CAPS) for all approved subjects listed in this document;
(b) National Policy Pertaining to the Programme and Promotion requirements of the National
Curriculum Statement Grades R-12 (N4PR Revised); and
(c) National Protocol for Assessment Grades R-12 (NPA).

Mrs Angie Motshekga,
MP Minister of Basic Education

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SECTION 1: INTRODUCTION TO THE CURRICULUM AND ASSESSMENT POLICY

1.1 Background

The *National Curriculum Statement Grades R-12 (NCS)* stipulates policy on curriculum and assessment in the schooling sector. To improve implementation, the National Curriculum Statement was amended, with the amendments coming into effect in January 2012. A single comprehensive Curriculum and Assessment Policy document was developed for each subject to replace Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines
in Grades R-12.

1.2 Overview

(a) The National Curriculum Statement Grades R-12 (January 2012) represents a policy statement for learning, teaching and assessment in South African schools and comprises the following:

(i) Curriculum and Assessment Policy Statements for each approved school subject,

(ii) The policy document, National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R-12; and

(iii) The policy document, National Protocol for Assessment Grades R-12 (January 2012).

(b) The National Curriculum Statement Grades R-12 (January 2012) replaces the two current national curricula statements, namely the

(i) Revised National Curriculum Statement Grades R-9, Government Gazette No. 23406 of 31 May 2002, and

(ii) National Curriculum Statement Grades 10-12 Government Gazettes, No. 25545 of 6 October 2003 and No. 27594 of 17 May 2005.

(c) The national curriculum statements contemplated in subparagraphs b (i) and (ii) comprise the following policy documents which will be incrementally repealed by the National Curriculum Statement Grades R-12 (January 2012) during the period 2012-2014:

(i) The Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines for Grades R-9 and Grades 10 – 12,

(ii) The policy document, National Policy on assessment and qualifications for schools in the General Education and Training Band, promulgated in Government Notice No. 124 in Government Gazette No. 29626 of 12 February 2007,

(iii) The policy document, the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF), promulgated in Government Gazette No.27819 of 20 July 2005,

(iv) The policy document, An addendum to the policy document, the National Senior Certificate:

A qualification at Level 4 on the National Qualifications Framework (NQF), regarding learners with special needs, published in Government Gazette, No.29466 of 11 December 2006, is incorporated in the policy document, National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R-12; and

(v) The policy document, An addendum to the policy document, the National Senior Certificate:

A qualification at Level 4 on the National Qualifications Framework (NQF), regarding the National Protocol for Assessment (Grades R-12), promulgated in Government Notice No.1267 in Government Gazette No. 29467 of 11 December 2006.

(d) The policy document, *National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R-12*, and the sections on the Curriculum and Assessment Policy as contemplated in Chapters 2, 3 and 4 of this document constitute the norms and standards of the *National Curriculum Statement Grades R-12.* It will therefore, in terms of *section 6A* of the *South African Schools Act, 1996 (Act No. 84 of 1996,)* form the basis for the Minister of Basic Education to determine minimum outcomes and standards, as well as the processes and procedures for the assessment of learner achievement to be applicable to public and independent schools.

1.3 General aims of the South African Curriculum

(a) The *National Curriculum Statement Grades R-12* gives expression to the knowledge, skills and values worth learning in South African schools. This curriculum aims to ensure that children acquire and apply knowledge and skills in ways that are meaningful to their own lives. In this regard, the curriculum promotes knowledge in local contexts, while being sensitive to global imperatives.

(b) The National Curriculum Statement Grades R-12 serves the purposes of:

- equipping learners, irrespective of their socio-economic background, race, gender, physical ability or intellectual ability, with the knowledge, skills and values necessary for self-fulfillment, and meaningful participation in society as citizens of a free country,
- through the process of multi-certification in the GET phase,
- providing access to higher education,
- facilitating the transition of learners from education institutions to the workplace; and
- providing employers with enough profile of a learner's competences.

(c) The National Curriculum Statement Grades R-12 is based on the following principles:

- **Social transformation:** ensuring that the educational imbalances of the past are redressed, and that equal educational opportunities are provided for all sections of the population,
- **Active and critical learning:** encouraging an active and critical approach to learning, rather than rote and uncritical learning of given truths,
- **High knowledge and high skills:** the minimum standards of knowledge and skills to be achieved at each grade are specified and set high, achievable standards in all subjects,
- **Progression:** content and context of each grade shows progression from simple to complex,
- **Human rights, inclusivity, environmental and social justice:** infusing the principles and practices of social and environmental justice and human rights as defined in the Constitution of the Republic of South Africa.
- The National Curriculum Statement Grades R-12 is sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability and other factors,

- Valuing indigenous knowledge systems: acknowledging the rich history and heritage of this country as important contributors to nurturing the values contained in the Constitution; and
- Credibility, quality and efficiency: providing an education that is comparable in quality, breadth and depth to those of other countries.

(d) The National Curriculum Statement Grades R-12 aims to produce learners that are able to:

- identify and solve problems and make decisions using computer skills, critical and creative thinking,
- work effectively as individuals and with others as members of a team,
- organise and manage themselves and their activities responsibly and effectively,
- collect, analyse, organise and critically evaluate information,
- communicate effectively using visual, symbolic, digital and/or language skills in various modes,
- use science, technology, coding and robotics effectively and critically showing responsibility towards the environment and the health of others,
- demonstrate an understanding of the world as a set of related systems by recognising that problem solving contexts do not exist in isolation, and
- having the ability to adapt to a changing world and workplace.

(e) Inclusivity should become a central part of the organisation, planning, teaching and assessment at each school. This can only happen if all teachers have a sound understanding of how to recognise and address barriers to learning, and how to plan for diversity.

The key to managing inclusivity is ensuring that barriers are identified and addressed by all the relevant support structures at an institutional level, the School Assessment Team (SAT) and School Based Support Team (SBST), at District level the District-Based Support Teams (DBST), parents and Special Schools as Resource Centres. To address barriers in the classroom, teachers should *use various curriculum differentiation strategies* such as those included in the Department of Basic Education's *Guidelines for Inclusive Teaching and Learning* (2010).

1.4. Subjects and Time Allocation

1.4.1 Foundation Phase

(a) The instructional time in the Foundation Phase is as follows:

SUBJECT	GRADE R (HOURS)	GRADE 1-2 (HOURS)	GRADE 3 (HOURS)
Home Language	10	8/7	8/7
First Additional Language		2/3	3/4
Mathematics	7	7	7
Coding and Robotics	1	1	2
Life Skills: • Beginning Knowledge • Creative Arts • Physical Education • Personal and Social Well-being	6 (1) (2) (2) (1)	6 (1) 2 2 (1)	7 (2) (2) (2) (1)
TOTAL	**(24)**	**(24)**	**(27)**

(b) Instructional time for Grades R, 1 and 2 is 24 hours and for Grade 3 is 27 hours.

(c) Ten hours are allocated for languages in Grades R-2 and 11 hours in Grade 3. A maximum of 8 hours and a minimum of 7 hours are allocated for Home Language and a minimum of 2 hours and a maximum of 3 hours for Additional Language in Grades 1-2. In Grade 3 a maximum of 8 hours and a minimum of 7 hours are allocated for Home Language and a minimum of 3 hours and a maximum of 4 hours for First Additional Language.

(d) In Life Skills Beginning Knowledge is allocated 1 hour in Grades R – 2 and 2 hours as indicated by the hours in brackets for Grade 3.

1.4.2 Intermediate Phase

(a) The instructional time in the Intermediate Phase is as follows:

SUBJECTS	HOURS
Home Language	6
First Additional Language	5
Mathematics	6
Natural Sciences and Technology	3.5
Coding and Robotics	2
Social Sciences	3
Life Skills • Creative Arts • Physical Education • Personal and Social Well-being	**4** (1.5) (1) (1.5)
TOTALS	**29.5**

1.4.3 Senior Phase

(a) The instructional time in the Senior Phase is as follows:

SUBJECTS	HOURS
Home Language	6
First Additional Language	5
Mathematics	6
Natural Sciences	3.5
Social Sciences	3
Life Orientation	2
Schools to replace any of the TWO (2) from the Occupational subjects:	
Technology	2
Economic Management Sciences	2
Creative Arts	2
Occupational Subjects: A minimum of any three subjects selected from **Group**_____ *Annexure ____, Tables* _____ of the policy document, *National Policy Pertaining to the Programme and Promotion Requirements of the National Curriculum Statement Grades R-12,* subject to the provisos stipulated in paragraph _____of the said policy document.	As per Cir S1 of 2018 (note subject lists)
Coding and Robotics	2
TOTALS	**29.5**

1.4.4 Further Education and Training Phase

(a) The instructional time in Grades 10-12 is as follows:

SUBJECTS	HOURS
Home Language	6
First Additional Language	5
Mathematics	6
Life Orientation	3.5
A minimum of any three subjects selected from **Group B** *Annexure B, Tables B1-B8* of the policy document, *National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R-12,* subject to the provisos stipulated in paragraph 28 of the said policy document.	12 (3x4h)
TOTALS	**27.5**

The allocated time per week may be utilised only for the minimum required NCS subjects as specified above and may not be used for any additional subjects added to the list of minimum subjects. Should a learner wish to offer additional subjects, additional time must be allocated for the offering of these subjects.

Recommend that digital skills, ender user computing, coding and robotics knowledge and skills be integrated into each subject during the review process of Sections 2 and 3 of from grade R-12.

SECTION 2: INTRODUCTION TO CODING AND ROBOTICS

2.1 What is Coding and Robotics?

The Coding and Robotics subject is central to function in a digital and information-driven world; apply digital ICT skills and transfer these skills to solve everyday problems in the development of learners. It is concerned with the various inter-related areas of Information Technology and Engineering. The subject studies the activities that deal with the solution of problems through logical and computational thinking.

In the Curriculum and Assessment Policy Statement (CAPS) for the subject Coding and Robotics in Intermediate Phase (Grades 7-9) has been organised into four Strands: Algorithms and Coding, Robotics Skills, Internet and E-communication and Application Skills. The Topics have been organised to ensure that the concepts developed in Intermediate Phase are reinforced in Senior Phase. Beginning Knowledge, Personal and Social relationships are integrated into the topics. Coding and Robotics is a subject that traverses across the other Senior Phase subjects namely Languages (home and First Additional), Natural Science, Technology, Life Skills, Social Sciences and Mathematics.

2.2 Specific Aims:

The Coding and Robotics subject is aimed at guiding and preparing learners to solve problems, think critically, work collaboratively and creatively, function in a digital and information-driven world, apply digital and ICT skills and to transfer these skills to solve everyday problems and its possibilities. Furthermore, the Subject aims at equipping learners to contribute in a meaningful and successful way in a rapidly changing and transforming society.

Through Coding and Robotics learners are exposed to a range of knowledge, skills and values that strengthen their:

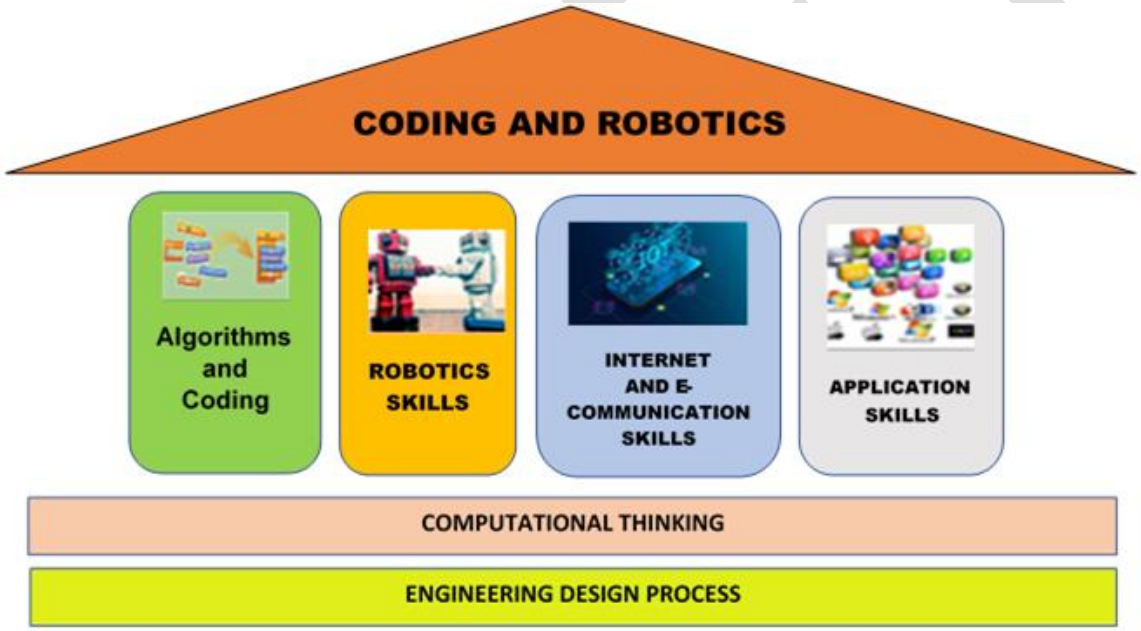
- aesthetic, creative skills and cognitive development, knowledge through engaging in music and visual art activities
- knowledge of digital and ICT skills supported by the technological process and computational thinking skills
- understanding of the relationship between people and the environment, awareness of social relationships, and elementary science.

2.3 Focus content areas:

The Coding and Robotics Foundation Phase subject consist of the following Knowledge Strands:

- Algorithms and Coding Skills
- Robotic Skills
- Internet and E-Communication Skills
- Application Skills

The Strands co-exist and overlap in their application, knowledge and skill levels. The Subject methodology is based on Computational Thinking and the Engineering Design Process**.**



Topics links and overlap

Throughout the Subject of Coding and Robotics it is important to note that there will always be a degree of overlap between topics. The fundamentals of each Topic are taught in its Strand but is also reinforced in other Strands. Algorithms and Coding are used to program the logic sequence that Robotics uses and the Application skills teach learners how to interact with different digital devices. Internet and E-communications relies on the use of Digital Devices that are taught in Application skills and uses the similar skills to compile reports and analyse data.

Algorithms and Coding

Algorithm and Coding programming skills in the Senior Phase are primarily developed by using a line based programming interface. Learners are introduced to a line based coding platform through a hybrid programming platform consisting of block based and line based coding. The line based programming platform makes use of easy to understand, syntax free programming where learners can focus on the programming concepts that are being taught. The following Algorithm and Coding concepts are introduced:

- Hybrid coding platform
- Flow diagrams, Logic gates and Truth Tables
- Variables Strings, Integer, Floats, Boolean and Lists
- Mathematical, Operational, Logic and Relational Operators
- Conditional and Nested Conditional Statements
- Looping Mechanisms
- Functions and parameter passing
- Programming libraries

Robotic Skills

Robotics consist of two merging fields that including Coding and Engineering. Learners continue with Mechanical and Electrical engineering systems. The Robotics Strand combines the Engineering Design Process and Computational Thinking Process. The Strand introduce Microcontrollers that will be coded using a line based coding platform. The Concepts and Skills taught are as follow:

- Logical processing steps
- Mechanical systems including pulleys, gears and linkages.
- Microcontrollers and components for input and output
- Hybrid and Line based programming
- CAD

Internet and E-Communication Skills

The Strand of Internet and e-Communications skills prepares learners to interact safely in a digital online and offline world. The following Concepts and Skills are taught in the Strand:

- Cyber threats, security and authentication

- Viruses and malware
- Augmented reality, Virtual reality, Machine learning and Internet of Things
- Social Media
- Big Data and data processing techniques

Application Skills

Application Skills comprises of end-user skills that are used on different digital platforms. In the Senior Phase learners are engaging with applications that build on data analysis and website development skills. The Application skills strand teaches the following skills and content:

- HTML and CSS
- Spreadsheet applications

2.4 Requirements for Coding and Robotics

2.4.1 Time Allocation

Strands *Grade 7-9 = 2 hours per week.*	**Terms 1 - 4** Hours per week	
	Grade 7	**Grade 8 - 9**
Algorithms and Coding	5	6
Robotic Skills	6	6
Internet and e-Communication Skills	2	1
Application Skills	3	3
Practical Assessment Task	2	2
Assessment	2	2
Total	**10 weeks**	**10 weeks**

The Coding and Robotics Subject is practically orientated and includes practical's which are recorded as formal assessments which needs to be included during teaching time. Informal Assessments continues during lessons when learners are not doing PAT's.

2.4.2 Resources

- Each learner must have a textbook / workbook / e-book. Schools must utilise book retrieval policy where applicable.

- Schools are required to ensure that the necessary tools, devices, materials and consumables be available for teaching, learning and assessment. These resources should be indexed and checked each term.
- The school should subscribe to a minimum of two or more subject related magazines for the teacher to keep abreast with the latest developments in the industrial environment. These magazines could also be lent out to learners (in the same way as library books). These resources must be readily available in the classroom or in the library.
- Schools offering Coding and Robotics must have a well-equipped Coding and Robotics lab for learners to complete the Practical Assessment Tasks. The Coding and Robotics lab needs to be secured with enough storage space for resources.
- The teacher should have a variety of reference books / e-books, charts and brochures in the classroom to stimulate the learners' interest in the subject.
- The teacher should have access to the internet to be able to source, download and print relevant and new information, as the industry environment is a dynamic industry continuously incorporating new trends and developments. The teacher should also have an e-mail, cloud storage facilities, as new information from subject advisors and other sources can be shared on digital platforms.
- The teacher needs to be trained in the context, content and pedagogy of the subject.
- Resources to offer Coding and Robotics as a subject are the responsibility of the school. The school should build up a collection of models, e.g. by asking learners, parents or mechanical, electrical and electronic repair workshops and suppliers to donate models.
- All resources should be captured in the LTSM inventory list and audited on a term basis; however, these resources should always be readily available for internal/external audits.
- Sustainable Support - Robotics and coding is a subject that requires sustained support. The Coding and Robotics lab requires regular resourcing for the purpose of completion of practical tasks and as well as maintenance.

2.4.2.1. Coding and Robotics Resources

The School Management Team (SMT) should take note of the implications that Coding and Robotics lab has on the budget of the school. Whilst it is common practice to provide a working budget, it is imperative to note that the budget should be structured not only to cater for completion of practical tasks by the learners, but should also allow for the teacher to replenish

tools and acquire consumables for experiments, demonstrations and simulations. The budget that schools develop should make provision for the following:

- Software licenses
- Cartridges, paper and storage media
- Breakage and maintenance
- Insurance
- Internet Connectivity
- Sustainability plan.

The teacher must also be allowed to supplement the teaching and learning support material in the form of posters, models, videos, periodicals and many more. Preventative maintenance of training kits/equipment on a regular basis, as well as provisioning for the inevitable failure of equipment should not be disregarded. The SMT should have a plan in place to regular phase out and replace obsolete tool, consumables and equipment.

2.4.2.1.1. Coding Requirements

- Free open source Software for block and Line based coding
- Free open source Software HTML editor

2.4.2.1.2. Robotics Requirements

- Microcontroller
- Basic Electrical Components
    - Switches
    - Batteries
    - Wires
    - Breadboards
    - LED's (Normal & RGB)
    - Resistors
    - DC Motors
    - Lightbulbs
    - Buzzer
    - MOSFET's/H Bridge/ Motor shield
    - Potentiometer
    - Servo's
    - Joystick Module
    - Bluetooth Module

- Sensors Modules:
    - Temperature
    - Humidity
    - Light
    - Motion
    - Proximity

- Basic Mechanical Components
    - Wheels and Axles
    - Pulleys
    - Linkages
    - Gears
    - Plastic/ Cardboard Fans
    - Fasteners
- The components may be made from recyclable materials.
- The following Tools are required:
    - Long nose Pliers
    - String
    - Glue Gun
    - Scissors
    - Project Knife
    - Rulers
    - Insulation Tape
    - Screw drivers
    - Hand Figure Saw
    - Soldering Iron
    - Soldering Mat
    - 3D Printer Plastic Reel

2.4.2.1.3. Infrastructure, Equipment and Finances

- Workspace in Coding and Robotic Labs for learners should be enough for team and individual work.
- A dedicated Coding and Robotics lab should be used.

- The school must procure basic robotics components which will include a selection of basic Electronic and Mechanical components etc. Procurement of LTSM resources should be based on needs analyses from the updated inventory list. Evidence of procurements should be kept for 5 years in line with the Public Finance Management Act (PMFA).
- Schools to provide secure storage space for LTSM.

2.4.2.1.4. Computing Hardware

Coding and Robotics require learners to work in pairs and individually on computers during contact time. The Coding and Robotics Laboratory should provide for the following minimum hardware specs for Computing:

Computers should have a lifespan of 5 years. This will ensure that the Department receives value for money on the investments made.

- 2.0 GHz 64-bit processor (Core I5 CPU minimum)
- 8 GB RAM + 2GB Graphics card
- 500 GB secondary storage
- 3 USB ports
- Keyboard and mouse
- Monitor with a resolution of 1024x768 or higher
- Data projector or demonstrating software (LED Lens with 3000 lumens)
- One high-speed printer per Coding and Robotics Lab
- Internet Access
- Network
- 3D Printer
- Integrated or standalone webcam

2.4.2.1.5. Software Requirements:

- Antivirus and Internet Security
- Cloud Storage Services
- Operating System
- Office Suite (Text editing, Presentation and Spreadsheets)
- Application Software for Hybrid Block based Coding, Multimedia Editing and Drawing
- Screen Control

2.5 Teaching Coding and Robotics in Senior Phase

Teaching and Learning in Coding and Robotics involves the development of a range of process and design skills. These skills are underpinned by the Engineering Design Process and the Computational Thinking Process throughout the Subject. Through the subject learners will develop the ability to think objectively and use a variety of forms of reasoning. Teachers need to create an environment that allows learners to tap into their curiosity about digital technology, supports their creativity, responsibility and grow their confidence in using technology through Coding and Robotics.

The Cognitive and Practical Coding and Robotic Skills that learners will develop are:

- Accessing and Recalling of information – use a variety of sources to gather information, remember relevant knowledge and key concepts to develop efficient and functional Coding and Robotics programs.
- Observing – Noting details in programs and Coding program and Robotic structures.
- Comparing – noting similarities and differences between different types of Code, algorithms and Robots.
- Measuring – using measure instruments focusing on rulers.
- Sorting and Classifying – sort and classify code elements, mechanical components and electrical components.
- Problem solving – being able to develop programs and robots based on the needs and wants of their community.
- Raising questions – being able to think of, and articulate relevant questions about problems, issues, and Coding and Robotics within their environment.
- Logic Process – identify the logical reasoning in how solutions should be developed for the problems they have identified.

- Digital Process – the ability to identify Inputs, the processes involved and the output generated in a Program.
- Planning and Designing projects and programs – thinking through the method for an activity in advance. Identifying the components, materials and code required to complete a given task.
- Recording information – recording of circuit designs, code, structures and components, in a systematic way, including drawings and descriptions, used to complete a given task.
- Interpreting information: use data provided or gathered and process it to get to a meaningful output.
- Building Projects – building or assembling robotics projects using the appropriate tools and skills including measuring, cutting, folding, rolling, gluing, fastening and building circuits.
- Evaluate and improve – using criteria to assess codes and structures with the goal of improving the final code or robot.
- Communication – using various applications to communicate in a written, visual, oral, presentation or graphic form to other people.

2.5.1. Engineering Design Process (IDMEC)

Coding and Robotics develop valuable problem-solving skills that will benefit every learner in many life contexts for the 4IR and beyond. As learners' progress through a task, they must be taught the associated knowledge and the skills needed to design and create a solution. Knowledge is important and the learners must show that they can use the knowledge.

The Engineering Design Process (Investigate, Design, Make, Evaluate, Communicate – IDMEC) forms the backbone of the subject and should be used to structure the delivery of all learning aims. Learners should be exposed to a problem, need or opportunity as a starting point. They should then engage in a systematic process that allows them to develop solutions that

Criteria for teaching and assessing design features:

- Originality and aesthetics
- Value for money/cost effectiveness
- Fit-for-purpose and suitability of materials
- Ease of manufacture
- Safety and ergonomics
- Environmental impact
- Bias towards or against a group

solve problems, rectify design issues and satisfy needs.

Investigation in this subject involves finding out about contexts of the problem, investigating or evaluating existing products in relation to key design aspects and performing practical tests to develop understanding of aspects of the content areas or determining a product's fitness-for-purpose. While investigating, learners should be provided with opportunities to explore values, attitudes and indigenous knowledge to develop informed opinions that can help them to make compromises and value judgements. Investigation can happen at any point in the Design Process. It should not be something that must be completed before design begins.
Designing, making and evaluating. These skills should not be separate – they are inter-related. Part of the modernisation of **Design and Making**. Designs can be drafted, virtually assembled and evaluated before they are produced.

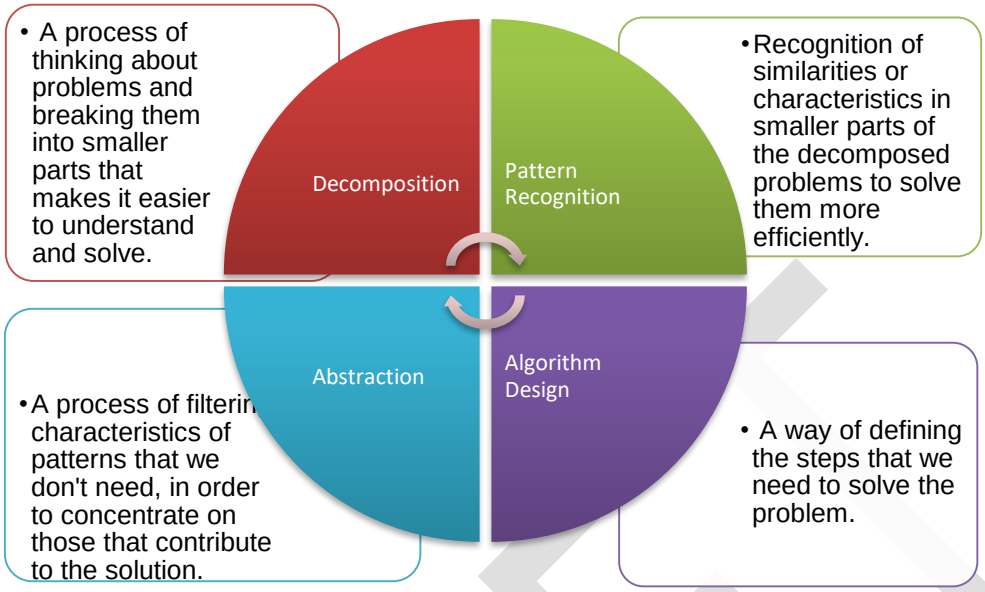
Evaluation skills, for example, are used to choose ideas.
At this level, learners should be introduced to key aspects of design. These should be used to evaluate both existing and designed products against predetermined criteria. When making, learners should be encouraged to continue to reflect on their progress against these criteria and to modify their solutions based on problems encountered. As learner's progress, they should be able to demonstrate increasing accuracy and skill, better organisation and safer working practices.

Communication should also be integral to the overall process. Learners should be recording and presenting progress in written and graphical forms on an on-going basis. Their presentations should show increasing use of media, levels of formality and conventions as they progress through the phase.

2.5.2. Computational Thinking

In education, Computational Thinking is a set of problem-solving methods that involve expressing problems and their solutions in ways that a computer could also execute.

This is a dynamic process consisting of four steps, that are outlined below:



2.5.3. Literacy and Numeracy Skills integration:

Coding and Robotics relies on the ability of learners to read and write and is central to successful learning in the Subject. Even though Coding and Robotics relies on Hybrid Block Based and Line based Coding in the Senior Phase, learners need to be able to communicate their ideas and thoughts using writing and should be able to construct meaningful and logical thoughts. Learners should engage with written examples of block code which they need to interpret and use as part of their learning.

Learners should be able to read the labels, buttons, icons and titles used on User Interfaces of various Applications. Their reading and writing skills will further be required in the use of various applications where they will be required to read and follow instructions on digital devices. These instructions include logical steps that needs to be executed in the applications or written in Hybrid Block Based and Line based Coding. The learner's ability to read and write well is critical when they are assessed both informally and formally.

2.5.4. Coding and Robotics in a localised Context

In the Coding and Robotics, curriculum is organised in strands. The use of strands integrates the content from the different subjects' areas where possible and appropriate. Teachers are encouraged to adapt the scenarios so that they are suitable for their school within the South African contexts.

2.5.5. Weighting of Strands and Topics

The Coding and Robotics curriculum is designed across 40 weeks of the year. Approximate time allocations are given for each topic during each term, indicating the weighting that each topic should receive. Coding and Robotics practical application time should be incorporated into the teaching schedule.

SECTION 3: OVERVIEW OF TOPICS AND ANNUAL TEACHING PLANS

3.1 Overview of Topics

Listed below are the topics per grade with a short explanation of the focus. Note that some topics are continued from Grade 7 to 9 showing progression and increasing in complexity from year to year, whilst other topics cease at some stage. This is not due to its importance diminishing, but rather due to the integration thereof.

Term 1			
Topics	**Grade 7**	**Grade 8**	**Grade 9**
Internet and E-Communication	• Augmented reality • Real world applications of augmented reality	• Introduction to cyber security • Cyber threats – hacking • Strong passwords	• Introduction to social media - what is social media? - social media platforms: Text, Video, Image and Sound
Algorithms and Coding	• Comparisons between line based coding and block based coding • Flow charts - Start, Stop, Process and Flow • Augmented reality project	• Binary numbers • Variables • Introduction to shell environment - Mathematical operations - Order of operations - input and output • Syntax errors	• Continue with logic gates and truth tables o combining three gates • Programming o The while loop o Continue with for loop
Application skills	• Introduction to HTML - Head - Body - Paragraph - Line Breaks - Title • Spreadsheet application o Data types	• HTML - Hyperlinks to a(n) ▪ page ▪ email ▪ document ▪ anchor • Spreadsheet application - Sorting and filtering data by columns	• HTML - Adding tables to a webpage ▪ Table sizes ▪ Column width • Spreadsheet application - Absolute references
Robotics skills	• CAD drawing - Line tool - Rectangle tool - Dimension tool - Extrusion tool • Robotics - Potentiometers	• CAD drawing - Mechanical components: Gears - Relate tools: Connect, Equal, Horizontal and vertical • Robotics - Servos - Hybrid programming (block and line based)	• CAD drawing - Drawing assembly of four parts (continued) - Display methods - Mechanical components: Pulleys • Robotics - continue with servos and joysticks

Term 2			
Topics	**Grade 7**	**Grade 8**	**Grade 9**
Internet and E-Communication	• Virtual reality • Real world applications of Virtual Reality • Hardware for virtual reality • Virtual reality vs Augmented reality	• Cyber threats – software threats • Viruses and malware - Trojans and worms - Safeguarding against malware and viruses	• Advantages and disadvantages of social media - Marketing - Cyber bullying - Fake news • Social, ethical and legal issues of social networking
Algorithms and Coding	• Flowcharts o Decision blocks • Continue with line based programming comparison with block based	• Logic gate symbols - AND, OR, NOT • Truth tables - AND, OR, NOT • Mathematical functions - square root - exponents - round - random • Introduction to the IDE - Creating, saving and loading - Initializing variables - Changing variable values - Comments	• Programming - Introduction to modular programming - Process flow diagram - Defining and calling functions - Defining and calling functions with one parameter - List functions ▪ Appending ▪ Inserting ▪ Removing ▪ Clearing - List indexing • Machine learning project
Application Skills	• HTML - Formatting tags ▪ Headings ▪ Bold ▪ Italic - RGB colour format - Background colours - Text colour • Spreadsheet - Order of operations - Error indicators	• HTML - Style sheets - Style rules - Creating classes and ID's for tags • Spreadsheet application - Count if - Sum if	• HTML - Table alignment - Table colours - Cell spacing - Cell padding • Spreadsheet application - IF function • Boolean operators - AND - OR
Robotics Skills	• CAD drawing - Front, Side, Top, Bottom - Mechanical components - pulleys • Robotics - ultrasonic proximity sensor	• CAD drawing - Relate tools: Parallel, Perpendicular, Concentric • Robotics - potentiometers and servos	• CAD drawing - Exporting for 3D printing • Robotics - Bluetooth module

Term 3			
Topics	**Grade 7**	**Grade 8**	**Grade 9**
Internet and E-Communication	• Artificial reality • Real world applications of artificial reality • Advantages and disadvantages of artificial intelligence	• Cyber threats – email and internet threats • Phishing, Pharming and Spoofing	• What is streaming? • Types of streaming services • Uses of streaming services
Algorithms and Coding	• Continue with flowcharts • Continue with line based programming comparison with block based • Variables as data types - strings - integer - float - Boolean	• Continue with logic gates and truth tables - combining two gates • Programming - Boolean operators - Relational operators - IF statement - ELIF statements	• Event driven programming: using keyboard keys to move an object • Introduction to game design • Start with game project ○ Plan and design
Application Skills	• HTML - Unordered lists - Ordered lists - Background images - Foreground images • Spreadsheet - Worksheets ▪ Create ▪ Add ▪ Delete ▪ Rename ▪ Move	• HTML - Continue with classes and tags - Applying styles to text • Spreadsheet application - Conditional formatting ▪ Greater than ▪ Less than ▪ Between	• HTML - Plan and design a website - Working with robots - Text based navigation bar ▪ layout ▪ design • Spreadsheet applications - Conditional formatting ▪ Equal ▪ Text ▪ Duplicate values/text
Robotics Skills	• CAD drawing - Drawing views: Left and right - Mechanical components – wheels and axles - Cutting tool • Robotics - continue with DC motors and ultrasonic proximity sensors	• CAD drawing - Drawing assembly of two parts - Creating relationships on parts • Robotics - joystick module - continue with servos	• CAD drawing - Setting up a file for 3D printing • Robotics - Continue with Bluetooth module

Term 4			
Topics	**Grade 7**	**Grade 8**	**Grade 9**
Internet and E-Communication	• Basic machine learning • Artificial intelligence of the Internet of Things	• Biometric authentication • Multiple levels of security	• Introduction to Big Data • Analysing of Data using AI techniques
Algorithms and Coding	• Machine learning methods • Machine learning API's	• Strings operations - length - indexing - substrings - upper- and lowercase - concatenation of strings • Lists - creating a list - joining two lists • Introduce libraries: Graphics library - forward movement - turn left/right - pen up/down • The structure of a for loop	• Continue and complete gaming project started in previous term.
Application Skills	• HTML - Create a website - health and safety for technology • Spreadsheet - Cell formatting ▪ Autofill ▪ Cell size ▪ Merge ▪ Text direction ▪ Wrapping ▪ Splitting	• HTML - Create a website – health and safety in manufacturing - Adding videos - Applying style sheets to paragraphs • Spreadsheet application - Chart types: Pie charts and bar chart (2D and 3D) - Create, format and edit charts	• HTML - Complete website started in previous term • Spreadsheet application - Chart types: Scatter plots and line graphs - Chart editing ▪ Gridlines ▪ Legends
Robotics skills	• CAD drawing - Revolve tool - Structures – design a chassis • Robotics - Complete project	• CAD drawing - Drawing assembly of three parts (continued) - Part painter • Robotics - Complete project	• CAD drawing - Continue with 3D printing • Robotics - Complete project

3.2 Annual Teaching Plans

3.2.1 GRADE 7: TERM 1

WEEK	TOPIC	CONTENT
	Scenario /Context for the PAT	South Africa is prone to sudden, catastrophic collapse, which may lead to death, injury or structural damage. These features are known as sinkholes and they occur in areas situated under dolomite rock. Given enough time and the correct triggering mechanisms, these incidents occur mainly due to man's activities, influenced by factors such as: ❖ the ingress of water from leaking water-bearing services, ❖ poorly managed surface water drainage, and ❖ ground water level drawdown. Gauteng Province, parts of Mpumalanga, Limpopo, North West and Northern Cape Provinces, are underlain by dolomite. Research has established that over the past 50 years, Sinkholes have been the direct cause of some deaths in South Africa. Sinkholes not only cause damage to developments and infrastructure; their remediation costs are also high. • Read the scenario and identify new vocabulary (meaning of new words) • Digest the problem statement and identify possible solutions Practical: (Design): Identify and draft a Design Brief, Specification, and Constraints.
Week 1 (2 hours)	Internet and E-communications	The following Concepts for Internet and E-communications are revised from previous grades: • What is Automation • Internet of Things • Cloud computing The following Concepts for Internet and E-communications are introduced: • What is Augmented Reality • Real world applications of augmented reality. Examples that can be used in class: • Teacher demonstrates the concept through AR application on a tablet or phone. • Teacher provides learners with examples of Real World applications of AR. Examples: Design and Modelling. Medicine. AR Games. AR Maps. • Learners can download a AR application that allows sharing of messages e.g. Augmented reality treasure hunt application. • Learners discuss how they would use AR in the context in which they live. Learners plan a simple AR application that they can implement.
Week 2 (2 hours)	Algorithms and Coding	The following Concepts for Algorithms and Coding are revised from Grade 6: • Block based coding - Loops • Input, process and output The following Concepts for Algorithms and Coding are introduced: • Introduce line based comparison to block coding Examples that can be used in class: • Learners are provided with a simple block based programmes with their line based counterparts as examples. • Learners are provided with simple block based and their associated line based counterparts – learners match the line based with the block based programs.
Week 3 (2 hours)		The following Concepts for Algorithms and Coding are introduced: • Introduction to flowcharts - Start, Stop, Process and directional flow. - Variables Examples that can be used in class: • Learners are provided with flow charts that receive an input – learners use the input and follow the flow diagram to determine the output.

Week 4 (1 hour)		The following Concepts for Algorithms and Coding are introduced: - Augmented reality (basic) Examples that can be used in class: • Learners use a plugin to add to their camera to their block based program. Learners will need to create a code based on what their camera observes.
Week 4 (1 hour)	Application Skills	The following Concepts for Application Skills are revised from Grade 6: • Spreadsheet User interface • Spreadsheet Rows and Columns. • Filter and sorting • Functions (sum, average, max, min and round) The following Concepts for Application Skills are introduced: • Introduce Data Types: - General - Currency - Text - Number - Percentage Examples that can be used in class: • Learners are proved with a Table populated with data that needs to formatted according to the correct data in the Column. The learners need to apply functions to the data to determine the following information: - Sum of the numbers - Average of the numbers - The biggest number(MAX) - The smallest number (MIN)
Week 5 (2 hours)	Application Skills	The following Concepts for Application skills are introduced: • Hypertext mark-up languages (HTML) • HTML language editor • Setting up webpage document structure • Local and remote hosting • Introduction to document structure elements and tags - HTML - Head - Body - Paragraph - Line break. - Title Examples that can be used in class: • Learners can create a basic webpage using the following tags and elements: - HTML - Head - Body - Paragraph - Line break. - Title
Week 6 (2 hours)	Robotics Skills	The following skills for Robotics are revised from Grade 6: • Different Drawing Tools: - 2D drawing tools

		- 3D Extrusion tools
		- Dimension tools
		- User interface for a CAD Application
		
		The following Concepts for Robotics skills are introduced:
		• Mechanical Components:
		  • Linkages (2 links)
		• Drawing Planes and Views:
		  • Front, Side, Top or Bottom
		• The following skills:
		• Create a new drawing
		• Save a drawing
		• Basic Drawing Tools
		  - Line tool.
		  - Rectangle Tool
		  - Dimension tool
		  - Extrusion Tool
		
		Example to be used in class.
		• Learners are provided with mechanical Linkage's drawings containing dimension and need to recreate them. The drawing will require the minimum use of 2 drawing planes and require the following drawing tools:
		  - Line tool.
		  - Rectangle Tool.
		  - Dimension tool.
		  - Extrusion Tool.

Week 7 (2 hours) **Week 8 (2 hours)**	Robotics Skills	The following Concepts for Robotics are revised from Grade 6: • Breadboards • Microcontroller • Basic Electronic Components • Input, Process and Output The following Concepts for Robotics are introduced: • Continue with buzzers from Grade 6 • Introduce potentiometer Examples that can be used in class: • Learners program a microcontroller where they have to connect a potentiometer and a Buzzer. The potentiometer will be used to change the volume of a buzzer. • Learners complete a Coding and Circuit worksheet. The Coding and Circuit worksheet must show the connection between components and microcontrollers indicating the relevant code for the circuit that was built and coded. The following Concepts for Robotics are introduced: • Continue with LEDs from Grade 6 • Continue with potentiometer from previous week Examples that can be used in class: • Learners program a microcontroller where they have to connect a potentiometer and an LED. The potentiometer will be used to change the brightness of the LED. • Learners complete a Coding and Circuit worksheet. The Coding and Circuit worksheet must show the connection between components and microcontrollers indicating the relevant code for the circuit that was built and coded.
Week 9 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment - Mini PAT Term 1
Week 10 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment -Tests

GRADE 7: TERM 2

WEEK	TOPIC	CONTENT
Week 1 (2 hours)	**All Pillars Scenario** Internet and E-communications	Scenario used as context for all practical work The following Concepts for Internet and E-communications are revised from previous term: • What is Augmented Reality • Real world applications of augmented reality. The following Concepts for Internet and E-communications are introduced: • What is Virtual Reality(VR) • Real world applications of virtual reality • Differentiate between VR and AR • Hardware for VR Examples that can be used in class: • Teacher provides learners with examples of Real World applications of VR. Examples: Design and Modelling, Medicine. Digital twin. • Teachers discusses the hardware used for VR applications. • Learners can watch videos of real world applications of VR. • Learners or teacher assembles a VR headset using smart device and cardboard. A suitable VR app can be downloaded for learners to experiment with. • Learners can discuss a possible VR application idea for the context in which they live.
Week 2 (2 hours)	Algorithms and Coding	The following Concepts for Algorithms and Coding are revised from previous term: • Block based coding - Loops and decision making • Input, process and output The following Concepts for Algorithms and Coding are introduced: • Introduction to flowcharts - Decision block • Continue with flowcharts from previous term - Start, Stop, Process and directional flow. - Variables Examples that can be used in class: • Learners are provided with flow charts that contains a decision block. Given a specific input, learners follow the flow diagram to determine the output.
Week 3 (2 hours)		The following Concepts for Algorithms and Coding are introduced: • Continue with line based comparison to block coding from previous week Examples that can be used in class: • Learners are provided with a simple block based programmes, containing a conditional statement, with their line based counterparts as examples. • Learners are provided with simple block based (containing a conditional) and their associated line based counterparts – learners match the line based with the block based programs.
Week 4 (1 hour)		The following Concepts for Algorithms and Coding are introduced: • Continue with Augmented reality (intermediate) from previous term Examples that can be used in class:

		• Learners use a plugin to add to their camera to their block based program. Learners will need to create a code based on what their camera observes.
Week 4 (1 hour)	Application Skills	The following Concepts for Application Skills are revised from previous term: • Functions (sum, average, max, min and round) • Data Types The following Concepts for Application Skills are introduced: • Continue with Data Types from previous term • Order of Operations (), / x + - • Error Indicators: - ####### - #NAME! - #DIV/0! - #REF! - #VALUE! - #NUM! Examples that can be used in class: • The Teacher discuss the order of Operations with learners and use examples of how they are applied in formulas. • Teacher discuss the different types of errors and the way to fix them. • Learners are provided with a data set and need to use formulas to determine the answer. Learners should apply the order of operations to the data set. • Learners are given a Table populated with data containing specific Errors and they need to fix the errors according to the data types.
Week 5 (2 hours)	Application Skills	The following Concepts for Application skills are revised from previous term: • Hypertext mark-up languages (HTML) • HTML language editor. • Setting up webpage document structure. • Document structure elements and tags. The following Concepts for Application skills are introduced: • Formatting tags: - Headings - Bold - Italic • RGB colour format • Background colours (background-colour:) • Text colours (foreground-colour:) Examples that can be used in class: • Learners can create a basic webpage using the following tags and elements: - Document tags - Formatting tags - Text colours - Background colours
Week 6 (2 hours)	Robotics Skills	The following Concepts for Applications skills are revised from previous term: • Different Drawing Tools: - 2D drawing tools - 3D Extrusion tools - Dimension tools - User interface for a CAD Application The following Concepts for Applications skills are introduced: • Mechanical Components: - Pulleys (2 Pulleys) • Continue with Drawing Planes and views from previous term: - Front, Side, Top or Bottom • Continue with the following skills from previous grade: • Create a new drawing • Save a drawing

		• Continue with Basic Drawing Tools - Line tool. - Rectangle Tool. - Circle Tool. - Dimension tool. - Extrusion Tool Example to be used in class. • Learners are provided with mechanical Pulley's drawings containing dimension and need to recreate them. The drawing will require the minimum use of 2 drawing planes and require the following drawing tools: - Line tool. - Rectangle Tool. - Circle Tool. - Dimension tool. - Extrusion Tool
Week 7 (2 hours)	Robotics Skills	The following Concepts for Robotics are revised from previous term: • Breadboards • Microcontroller • Basic Electronic Components • Input, Process and Output The following Concepts for Robotics are introduced: • Introduce Ultrasonic proximity sensor • Continue with Buzzer from previous grade Examples that can be used in class: • Learners program a microcontroller where they have to connect an ultrasonic proximity sensor, and a buzzer. The buzzer should sound whenever an object moves within the proximity of the proximity sensor. • Learners complete a Coding and Circuit worksheet. The Coding and Circuit worksheet must show the connection between components and microcontrollers indicating the relevant code for the circuit that was built and coded.
Week 8 (2 hours)		The following Concepts for Robotics are introduced: • Continue Ultrasonic proximity sensor from previous week • Continue with LEDs from previous grade Examples that can be used in class: • Learners program a microcontroller where they have to connect an ultrasonic proximity sensor and an LED. The brightness of the LED should be dependent on the closeness of the object. • Learners complete a Coding and Circuit worksheet. The Coding and Circuit worksheet must show the connection between components and microcontrollers indicating the relevant code for the circuit that was built and coded.
Week 9 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment - Mini PAT Term 2
Week 10 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment -Exam

GRADE 7: TERM 3

WEEK	TOPIC	CONTENT
Week 1 (2 hours)	**All Pillars Scenario** Internet and E-communications	Scenario used as context for all practical work The following Concepts for Internet and E-communications are revised from previous term: • What is Virtual Reality(VR) • Real world applications of virtual reality • Internet of Things The following Concepts for Internet and E-communications are introduced: • What is Artificial Intelligence (AI) • Real world applications of AI • Advantages and Disadvantages of AI Examples that can be used in class: • Teacher provides learners with examples and discuss of Real-World applications of AI. Examples: Predictive text on phones. Search engines. Games. Expert systems. Natural language processing. Manufacturing. • Learners can watch videos of real-world applications of AI. • Learners experiment with and application that uses AI on a mobile devices of PC.
Week 2 (2 hours) **Week 3 (2 hours)** **Week 4 (1 hour)**	Algorithms and Coding	The following Concepts for Algorithms and Coding are revised from previous term: • Block based coding - Loops and decision making • Input, process and output The following Concepts for Algorithms and Coding are introduced: • Continue with flowcharts from previous term - Start, Stop, Process and directional flow - Decision block - Variables Examples that can be used in class: • Learners are provided with flow charts that contain a looping mechanism and a decision block. Given a specific input, learners follow the flow diagram to determine the output. • Learners create a block based program based on a flowchart provided by the teacher. The following Concepts for Algorithms and Coding are introduced: • Continue with line based comparison to block coding from previous term Examples that can be used in class: • Learners are provided with a simple line based program which they need to reproduce in a block based program. • Learners are provided with a simple line based program which they need to translate into a flow chart diagram. The following Concepts for Algorithms and Coding are introduced: • Variables as data types - String - Integer - Float - Boolean Examples that can be used in class:

		• Learners are provided with a list of various data types and need to categorize the given data types.
Week 4 (1 hour)	Application Skills	The following Concepts for Application Skills are revised from previous term: • Functions (sum, average, max, min and round) • Data Types The following Concepts for Application Skills are introduced: • Rename, Create, Move or Copy and Delete sheets. Examples that can be used in class: • Learners follow worksheet instructions to create, rename and re-order their worksheets according to given instructions.
Week 5 (2 hours)	Application Skills	The following Concepts for Application skills are revised from previous term: • Hypertext mark-up languages (HTML) • HTML language editor. • Setting up webpage document structure. • Elements and tags. • RGB colour format • Background colours (background-colour:) • Text colours (foreground-colour:) The following Concepts for Application skills are introduced: • Continue with elements and tags from previous term - Unordered lists (Bullets) - Ordered Lists - Background Images ▪ Load from file - Foreground images (Width and Height Attributes) ▪ Load from file Examples that can be used in class: • Learners can create a website with the following: - Document tags - Formatting tags - Colours - Lists - Images
Week 6 (2 hours)	Robotics Skills	The following Concepts for Applications skills are revised from previous term: • Different Drawing Tools: - 2D drawing tools - 3D Extrusion tools - Dimension tools - User interface for a CAD Application The following Concepts for Applications skills are introduced: • Mechanical Components: - Wheels - Axles • Drawing Views: - Left and Right • Continue with Drawing Planes and views from previous term: - Front, Side, Top or Bottom, • Continue with the following skills from previous term: - Create a new drawing - Save a drawing - Basic Drawing Tools o Line tool. o Rectangle Tool. o Circle Tool. o Dimension tool. o Extrusion Tool o Cutting Tool

		Example to be used in class. • Learners are provided with mechanical components drawings, wheels and axles, containing dimensions and need to recreate them. The drawing will require the minimum use of 2 drawing planes and require the following drawing tools: - Line tool. - Rectangle Tool. - Circle Tool. - Dimension tool. - Extrusion Tool - Cutting Tool.
Week 7 (2 hours)	Robotics Skills	The following Concepts for Robotics are revised from previous term: • Breadboards • Microcontroller • Basic Electronic Components • Input, Process and Output The following Concepts for Robotics are introduced: • Continue Ultrasonic proximity sensor from previous term • Continue with DC motors from previous term Examples that can be used in class: • Learners program a microcontroller where they have to connect an ultrasonic proximity sensor, motor shield and DC motor. The speed of the DC motor should be dependent on the closeness of the object. • Learners complete a Coding and Circuit worksheet. The Coding and Circuit worksheet must show the connection between components and microcontrollers indicating the relevant code for the circuit that was built and coded.
Week 8 (2 hours)		The following Concepts for Robotics are introduced: • Continue Ultrasonic proximity sensor from previous week • Continue with multiple DC motors from previous week Examples that can be used in class: • Learners program a microcontroller where they have to connect an ultrasonic proximity sensor, motor shield and two DC motors. The speed of the DC motors should be dependent on the closeness of the object. • Learners complete a Coding and Circuit worksheet. The Coding and Circuit worksheet must show the connection between components and microcontrollers indicating the relevant code for the circuit that was built and coded.
Week 9 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment Mini PAT Term 3
Week 10 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment Tests

GRADE 7: TERM 4

WEEK	TOPIC	CONTENT
Week 1 (2 hours)	Internet and E-communications	The following Concepts for Internet and E-communications are revised from the previous term: • What is Artificial Intelligence? • Real world applications of AI. • Advantages and Disadvantages of AI. • Internet of Things (IoT) The following Concepts for Internet and E-communications are introduced: • Basic of machine learning • Continue with IoT from the previous term • Artificial intelligence of the Internet of Things (AIoT) Examples that can be used in class: • Teacher provides learners with examples of Real-World applications of AIoT. Smart cameras, Smart cars. Intelligent shopping carts. Smart Shelves. • Learners can watch videos of real-world applications of AIoT. • Learners create a process flow diagram of how data is transferred in an AIoT in a system.
Week 2 (2 hours)	Algorithms and Coding	The following Concepts for Algorithms and Coding are revised from the previous term: • Block based coding - Loops and decision making • Input, process and output The following Concepts for Algorithms and Coding are introduced: • Introduction to machine learning methods • Introduction to machine learning Library (basic) Examples that can be used in class: • Learners connect to a machine learning Library. Learners populate the database with data, and complete the coding and design of the project.
Week 3 (2 hours)		The following Concepts for Algorithms and Coding are introduced: • Continue with machine learning methods from previous week • Introduction to machine learning Library (intermediate) Examples that can be used in class: • Learners connect to a machine learning Library. Learners populate the database with data.
Week 4 (1 hour)		The following Concepts for Algorithms and Coding are introduced: • Continue with machine learning Library (intermediate) from previous week Examples that can be used in class: • Learners continue with machine learning Library and database from the previous week. Complete the coding and design of the project.
Week 4 (1 hour)	Application Skills	The following Concepts for Application Skills are revised from the previous Term: • Data Types • Spread sheets User Interface • Formulas The following Concepts for Application Skills are introduced: • Cell Formatting: - Autofill

		- Cell size - Merge - Text direction - Wrapping - Split Examples that can be used in class: • Learners are provided with spreadsheets that they need to replicate using the following Cell formatting tools: - Autofill - Cell size - Merge - Text direction - Wrapping - Split
Week 5 (2 hours)	Application Skills	The following Concepts for Application skills are revised from the previous term: • Hypertext mark-up languages (HTML) • HTML language editor • Setting up webpage document structure • Elements and tags • RGB colour format • Background colours (background-colour:) • Text colours (foreground-colour:) • Lists • Images (Foreground and background) The following Concepts for Application skills are introduced: • Website development project • Introduction to technology health and safety Examples that can be used in class: • Learners create a webpage to educate people about health and safety when using technology. The project must include the following: - Document tags - Formatting tags - Colours - Lists - Images
Week 6 (2 hours)	Robotics Skills	The following Concepts for Applications skills are revised from the previous term: • Different Drawing Tools: - 2D drawing tools - 3D Extrusion tools - Dimension tools - User interface for a CAD Application. - Structures The following Concepts for Applications skills are introduced: • Structures - Chassis • Continue with Drawing Planes and views: - Front, Side, Top or Bottom • Continue with the following skills: - Create a new drawing - Save a drawing - Continue with Basic Drawing Tools - Line tool - Rectangle tool - Circle tool - Dimension tool - Extrusion tool - Cutting tool - Revolve tool Example to be used in class.

		• Learners are provided with different structures for chassis drawing's containing dimension and need to recreate them. The drawing will require the minimum use of 2 drawing planes and require the following drawing tools: - Line tool. - Rectangle Tool. - Circle Tool. - Dimension tool. - Extrusion Tool - Cutting Tool. - Revolve Tool
Week 7 (2 hours)	Robotics Skills	The following Concepts for Robotics are revised: • Breadboards • Microcontroller • Basic Electronic Components • Input, Process and Output • Structures • Mechanical Components: - Pulleys - Linkages The following Concepts for Robotics are introduced: • Structures • Continue with Potentiometer from previous terms • Continue with Buzzer from previous terms • Continue with LED from previous terms • Continue Ultrasonic proximity sensor from previous terms • Continue with DC motors from previous terms Examples that can be used in class: • Learners make the frame for their project based on the planning and requirements for their project. The learners need to place the appropriate electronic components in place where they can.
Week 8 (2 hours)		The following Concepts for Robotics are introduced: • Continue with Potentiometer from previous week • Continue with Buzzer rom previous week • Continue with LED rom previous week • Continue Ultrasonic proximity sensor rom previous week • Continue with DC motors rom previous week Examples that can be used in class: • Learners program a microcontroller based on the planning and requirements for their project and place it on the frame that was built. • Learners complete a Coding and Circuit worksheet for their project.
Week 9 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment - Mini PAT Term 4
Week 10 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment -Exam

3.2.2 GRADE 8: TERM 1

WEEK	TOPIC	CONTENT
	Scenario/ Context:	Two of the UNESCO Goals for Sustainable Development is ***No Poverty*** and ***Zero Hunger***. One of the strategies to address these two goals is through Agriculture to improve food security and alleviate poverty. Urbanisation has contributed to the migration of thousands of South Africans to cities for economic opportunities. Most of these hopefuls live below the poverty line. Household food gardens maybe part of a solution. Urban agriculture is the practise of farming and gardening in urban and peri-urban areas. This sector has become one of the fastest growing trends in the world, particularly in the emerging economies. This is due to the constant growth of the urban population. The industry of farming, horticultural, agricultural and animal husbandry activities that are mainly located in urban and rural areas. These areas are villages, cities, town, townships and metropoles. It is the production, processing, marketing and distribution of a variety of food and non-food products. The produce is mainly fruit and vegetables, animal nurture and cultivation of fish and wood production. These activities are done mainly in response to the daily demand of consumers who live there. They involve the use of the municipal water and reuse of human and material resources. Urban agriculture is not only about food, but also sustainability, health, social justice and income. Noting the South African Presidential vision for Smart Cities, we need to develop innovative solutions to combine the National Development Plan 2030 and Smart Cities Strategy to ensure food security. • Read the scenario and identify new vocabulary (meaning of new words) • Digest the problem statement and identify possible solutions Practical: Decomposing problem: Identify and draft a Design Brief, Specification, and Constraints.
Week 1 (1 hour)	Internet and E - Communication	The following Concepts for Internet and E-communications are revised from previous grades: • Internet • World wide web • Internet security The following Concepts for Internet and E-communications are introduced: • Introduction to Cyber security • Cyber Crime threats - hacking • Usernames and Passwords • Strong passwords Examples that can be used in class: • Teachers discusses the risks of cyber threats. Teacher can provide leaners of examples of famous hacking incidents. • Teachers discusses the characteristics of a strong password. - Minimum of 8 digits - Should not be personal word- e.g. your name - Should contain both lowercase and uppercase characters, numbers and non-alphanumeric characters.
Week 1 (1 hour)	Application Skills	The following Concepts for Application Skills are revised from previous grades: • Data Types • Spread sheets User Interface • Cell Formatting The following Concepts for Application Skills are introduced: • Sorting, Custom Sort and Filter Data by Column Examples that can be used in class: • Learners are provided with spreadsheets that they need to Sort using the following methods:

		- Sorting by Text or Number - Custom Sort - Filter by Text or Number
Week 2 (2 hours)	Application Skills	The following Concepts for Application skills are revised from previous grades: • Document tags • Formatting tags • Colours • Lists • Images The following Concepts for Application skills are introduced: • Hyperlink between pages • Hyper link to email address • Hyperlink to a document. • Hyperlink to an anchor. Examples that can be used in class: • Learners can create two basic webpages with different content in each webpage. Learners add a link in the first website to the second webpage. Learners can add a link to an email address, anchor and document.
Week 3 (2 hours)	Algorithms and Coding	The following Concepts for Algorithms and Coding are revised from previous grades: • Line based coding • Flow diagrams • Data types The following Concepts for Algorithms and Coding are introduced: • Introduction to Binary numbers: - 1 = on and 0 = off - The number system for computers • Introduction to data storage as variables Examples that can be used in class: • Teachers need to discuss that computers store variables in 1's and 0's, and that computers would need to be able to make distinctions between various types of variables. For example, 00110101 could either be interpreted as a number or as a character. Teachers can use the ASCII table as a resource for this activity.
Week 4 (2 hours)		The following Concepts for Algorithms and Coding are introduced: • Introduction to the shell programming environment - Some languages are case sensitive • Introduction to mathematical operations with integers and floating points - addition, subtraction, multiplication and division - order of operations • Introduction of syntax errors Examples that can be used in class: • Learners are provided with a worksheet containing simple mathematical problems which they need to calculate within the shell environment. The mathematical problems should be limited to a combination of addition, subtraction, multiplication and division.
Week 5 (2 hours)		The following Concepts for Algorithms and Coding are introduced: • Continue with the shell programming environment from previous week • Introduction to input to store variables • Introduction to the output function (print) • Introduction to typecasting - string to integer Examples that can be used in class: • Learners can store the input of two integer values and perform addition on those two variables – learners must take note of the outcome. Teachers can then

		discuss that inputs are stored as string by default, and would need to be casted to a different data type to perform arithmetical operations. • Learners perform basic mathematical operations on the variables that they have stored, and output the result using the output function.

Week 6 (2 hours)	Robotics Skills	The following Concepts for Applications skills are revised from previous grades:
		• Different Drawing Tools:
		  • User interface for a CAD Application
		  • Creating and saving drawings
		  • 2D drawing tools
		  • 3D Extrusion tools
		  • Mechanical: Linkages
		
		The following Concepts for Applications skills are introduced:
		• Introduce the Following Relate Tools:
		  - Connect
		  - Equal
		  - Horizontal and Vertical
		• Mechanical:
		  - Gears
		  - Continue with Linkages
		• Continue with Drawing Planes and views from previous Grades:
		  - Front, Side, Top or Bottom
		• Continue with the following skills from previous Grades:
		  - Basic Drawing Tools
		  - Line tool
		  - Rectangle tool
		  - Circle tool
		  - Dimension tool
		  - Extrusion tool
		  - Cutting tool
		  - Revolve tool
		
		Example to be used in class.
		• Learners are provided with different mechanical drawings of gears and linkages containing dimension and need to recreate them. The drawings require the use of following drawing tools:
		  - Connect
		  - Equal
		  - Horizontal and Vertical
		  - Line tool.
		  - Rectangle Tool.
		  - Circle Tool.
		  - Dimension tool.
		  - Extrusion Tool
		  - Cutting Tool.
		  - Revolve Tool

Week 7 (2 hours)	Robotics Skills	The following Concepts for Robotics are revised from previous grades: • Breadboards • Microcontroller • Basic Electronic Components • Input, Process and Output The following Concepts for Robotics are introduced: • Introduction to servos • Introduction to rotational working of servos • Continue working with hybrid code (block/line) from previous grade Examples that can be used in class: • Learners program a microcontroller where they have to connect a servo. The servo should rotate between 0 and 180 degrees using block based code. • Learners complete a Coding and Circuit worksheet. The Coding and Circuit worksheet must show the connection between components and microcontrollers indicating the relevant code for the circuit that was built and coded.

Week 8 (2 hours)		The following Concepts for Robotics are introduced: • Continue with servos from previous week • Continue with line based code from previous week Examples that can be used in class: • Learners program a microcontroller where they have to connect a servo and control its rotation using line based code only. • Learners complete a Coding and Circuit worksheet. The Coding and Circuit worksheet must show the connection between components and microcontrollers indicating the relevant code for the circuit that was built and coded.
Week 9 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment Mini PAT Term 1
Week 10 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment Tests

GRADE 8: TERM 2

WEEK	TOPIC	CONTENT
Week 1 (1 hour)	**All Pillars Scenario** Internet and E - Communication	Scenario used as context for all practical work The following Concepts for Internet and E-communications are revised from the previous term: • Introduction to Cyber security • Cyber Crime threats The following Concepts for Internet and E-communications are introduced: • Continue with cyber threats from the previous term – Software threats • Introduction to Viruses and Malware • Types of viruses: Trojan, worm. • How to safeguard against viruses Examples that can be used in class: • Teachers discusses the threats of viruses and malware. Teacher can provide leaners of examples of famous virus attacks. • Teachers discusses how leaners can safeguard against viruses. - Don't use flash drives that belong to other learners. - Safe email use - don't open attachments from an untrustworthy source. - Don't install software from untrustworthy sources.
Week 1 (1 hour)	Application Skills	The following Concepts for Application Skills are revised from previous grades: • Data Types • Formulas. The following Concepts for Application Skills are introduced: • Formulas: - Count - Sum if Examples that can be used in class: • Learners duplicate datasheets provided by the teacher and have to use the following Formulas to calculate specific totals: - Count - Sum if
Week 2 (2 hours)	Application Skills	The following Concepts for Application skills are revised from previous grades: • Document tags • Formatting tags • Colours • Lists • Images • Hyperlink between pages • Hyper link to email address The following Concepts for Application skills are introduced: • Introduction to styles sheets • Understanding styles sheets • Constructing style rules • Creating classes and IDs for applying tags Examples that can be used in class: • Learners create a new web page where they need to add classes and IDs.
Week 3 (2 hours)	Algorithms and Coding	The following Concepts for Algorithms and Coding are revised from previous grades: • Line based coding • Flow diagrams • Data types

		The following Concepts for Algorithms and Coding are introduced: • Introduction to logic gate symbols - AND - OR - NOT • Introduction to truth tables - AND - OR - NOT Examples that can be used in class: • Teachers provide a worksheet with truth tables and logic gates to learners, which will need to be discussed and completed in class. • Learners use the interactive shell to perform Boolean operations, for example - True AND False - True OR False - NOT (True AND False) - NOT (True AND False) - NOT (True OR NOT False)
Week 4 (2 hours)		The following Concepts for Algorithms and Coding are introduced: • Introduction to mathematical functions - square root - exponents - round - random Examples that can be used in class: • Learners are provided with a worksheet where they need to use the built-in functions to calculate the output.
Week 5 (2 hours)		The following Concepts for Algorithms and Coding are introduced: • Introduction to the IDE - Creating, saving and loading files - Initialising variables - Changing the values of variables - Comments - Continue with mathematical functions Examples that can be used in class: • Learners complete a worksheet that requires the learners to use variables and at least two mathematical functions to solve a given problem. The program that the learners write need to contain variables, comments and functions.
Week 6 (2 hours)	Robotics Skills	The following Concepts for Applications skills are revised from previous grades: • Different Drawing Tools: • User interface for a CAD Application. • Creating and saving drawings • 2D drawing tools • 3D Extrusion tools • Mechanical: Linkages and Gears • Relate Tools: - Connect - Equal - Horizontal and Vertical The following Concepts for Applications skills are introduced: • Introduce the Following Relate Tools: - Parallel - Perpendicular

		- Concentric • Continue with Linkages and Gears from previous grades • Continue with Basic Drawing Tools from previous grades - Line tool - Rectangle tool - Circle tool - Dimension tool - Extrusion tool - Cutting tool - Revolve tool Example to be used in class. • Learners are provided with different mechanical drawings of gears and linkages containing dimension and need to recreate them. The drawings require the use of following drawing tools: - Line tool. - Rectangle Tool. - Circle Tool. - Connect - Equal - Horizontal and Vertical - Line tool. - Rectangle Tool. - Circle Tool. - Dimension tool. - Extrusion Tool - Cutting Tool. - Revolve Tool
Week 7 (2 hours) **Week 8 (2 hours)**	Robotics Skills	The following Concepts for Robotics are revised from previous grades: • Breadboards • Microcontroller • Basic Electronic Components • Input, Process and Output The following Concepts for Robotics are introduced: • Continue with potentiometer from previous terms • Continue with servos from previous terms Examples that can be used in class: • Learners program a microcontroller where they have to connect a servo and a potentiometer. The output of the potentiometer should rotate the servo. • Learners complete a Coding and Circuit worksheet. The Coding and Circuit worksheet must show the connection between components and microcontrollers indicating the relevant code for the circuit that was built and coded. The following Concepts for Robotics are introduced: • Continue with multiple potentiometer (two) from previous week • Continue with multiple servos (two) from previous week Examples that can be used in class: • Learners program a microcontroller where they have to connect two servos and two potentiometers, and control the rotation of the servos using potentiometers. • Learners complete a Coding and Circuit worksheet. The Coding and Circuit worksheet must show the connection between components and microcontrollers indicating the relevant code for the circuit that was built and coded.
Week 9 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment Mini PAT Term 2
Week 10 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment Exams

GRADE 8: TERM 3

WEEK	TOPIC	CONTENT
Week 1 (1 hour)	Internet and E - Communication	The following Concepts for Internet and E-communications are revised from previous terms: • Introduction to Cyber security • Cyber Crime threats The following Concepts for Internet and E-communications are introduced: • Continue with Cyber Threats from previous term - Email and Internet threats • Phishing • Pharming • Spoofing Examples that can be used in class: • Teachers discusses the threats of phishing and pharming. Teacher explains the difference between phishing and Pharming attacks. • Teachers discusses how leaners phishing and pharming attacks. - Make sure that secure sites have the padlock symbol(https) . - Safe email use – don't respond to emails from untrustworthy sources. - Don't respond to emails that ask for your username and password. - If unsure about an email check with the source through another means of communication. Phone the person.
Week 1 (1 hour)	Application Skills	The following Concepts for Application Skills are revised from previous grades: • Data Types • Cell Formatting The following Concepts for Application Skills are introduced: • Use Conditional Formatting – Cell Rules: - Greater than - Less than - Between Examples that can be used in class: • Learners re-create a dataset from an example and have to apply the following conditional formatting cell rules to the data: - Greater than - Less than - Between
Week 2 (2 hours)	Application Skills	The following Concepts for Application skills are revised from previous grades: • Document tags • Formatting tags • Colours • Lists • Images • Hyperlinks • Style sheets • Classes and IDs The following Concepts for Application skills are introduced: • Continue with Classes and IDs for applying tags from previous term. • Apply styles for formatting text. Examples that can be used in class: • Learners create a new web page where they need to use style sheets for formatting text.
Week 3 (2 hours)	Algorithms and Coding	The following Concepts for Algorithms and Coding are revised from previous grades: • Line based coding • Flow diagrams • Data types

		The following Concepts for Algorithms and Coding are introduced: • Continue with logic gates from previous term - combining two gates • Continue with truth tables from previous term Examples that can be used in class: • Teachers provide learners with a worksheet containing various configurations of combinations of two gates and learners will need to complete truth tables to determine possible outcomes of the given gates.
Week 4 (2 hours)		The following Concepts for Algorithms and Coding are introduced: • Continue with the IDE from previous term • Introduce relational operators - less than - greater than - equal - not equal - greater than or equal to - less than or equal to • Introduction to basic IF statements - executing one command - executing multiple commands (using indentation) • Introduction to ELIF statements - one ELIF condition Examples that can be used in class: • Learners write a program that generates and stores a random number. The user must be allowed to submit and guess, and the program should inform the users whether they were correct, have guesses too high or guessed too low. • Learners write a program that accepts two numbers from the user. The output must inform the user which number is the largest of the two.
Week 5 (2 hours)		The following Concepts for Algorithms and Coding are introduced: • Continue with Boolean operators (AND / OR / NOT) from previous week • Continue with IF statements using AND / OR / NOT from previous week • Introduce IF/ELSE statement - multiple ELIF statements (up to three) Examples that can be used in class: • Learners write a program that accepts two numbers from the user. The output must inform the user which number is the largest of the two, or if the given inputs are equal. • Learners write a program that accepts three numbers from the user. The output must inform the user which number is the largest of the three.
Week 6 (2 hours)	Robotics Skills	The following Concepts for Applications skills are revised from previous grades: • Different Drawing Tools: • User interface for a CAD Application • Creating and saving drawings • 2D drawing tools • 3D Extrusion tools • Relate tools • Mechanical: Linkages and Gears The following Concepts for Applications skills are introduced: • Introduce the Assembly Drawing (2 Parts) • How to create relationships on parts • Continue with Linkages and Gears from previous term Example to be used in class.

		• Learners are provided with mechanical Parts that needs to be drawn as separate parts, saved and the assembled as an assembly drawing. Learners need to create the appropriate relationships between parts in the assembly. The assembly needs to consists of a minimum of 2 parts.
Week 7 (2 hours)	Robotics Skills	The following Concepts for Robotics are revised: • Breadboards • Microcontroller • Basic Electronic Components • Input, Process and Output The following Concepts for Robotics are introduced: • Introduce microcontroller joystick module • Continue with servos from previous term Examples that can be used in class: • Learners program a microcontroller where they have to connect a servo and a microcontroller joystick module. The output of the joystick should rotate the servo. • Learners complete a Coding and Circuit worksheet. The Coding and Circuit worksheet must show the connection between components and microcontrollers indicating the relevant code for the circuit that was built and coded.
Week 8 (2 hours)		The following Concepts for Robotics are introduced: • Continue with microcontroller joystick module from previous week • Continue with multiple servos (two) from previous week Examples that can be used in class: • Learners program a microcontroller where they have to connect two servos and a microcontroller joystick module, and control the rotation of the servos using line based coding. • Learners complete a Coding and Circuit worksheet. The Coding and Circuit worksheet must show the connection between components and microcontrollers indicating the relevant code for the circuit that was built and coded.
Week 9 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment Mini PAT Term 3
Week 10 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment Tests

GRADE 8: TERM 4

WEEK	TOPIC	CONTENT
Week 1 (1 hour)	Internet and E - Communication	The following Concepts for Internet and E-communications are revised from previous terms: • Introduction to Cyber security • Cyber Crime threats • Passwords The following Concepts for Internet and E-communications are introduced: • Continue with Cyber Security from previous terms • How to safeguard against cyber security attacks • Biometric authentication • Multiple levels of security Examples that can be used in class: • Teacher can discuss the different types of biometric authentication. - Fingerprint - Facial recognition - Retina recognition - Gait recognition - Voice recognition • Teachers can explain to learners how different security methods can be combined to have to have multiple levels of security. • Learners can be asked to discuss a password recovery method for email accounts.
Week 1 (1 hour)	Application Skills	The following Concepts for Application Skills are revised from previous terms: • Data Types • Cell Formatting • Charts • Formulas The following Concepts for Application Skills are introduced: • Chart Types - 2D/3D Pie Charts - 2D/3D Bar Charts • Continue with Charts from previous term: - Create, format and edit - Meaningful titles and labels Examples that can be used in class: • Learners create a spreadsheet with a data set. They need to create Charts from the data and add meaningful titles and labels. They need to use the following two types of 2D/3D Charts: - Pie - Bar
Week 2 (2 hours)	Application Skills	The following Concepts for Application skills are revised from previous terms: • Document tags • Formatting tags • Colours • Lists • Images • Hyperlinks • Style sheets • Classes and IDs The following Concepts for Application skills are introduced: • Continue with website development from previous term. • Adding videos to a website • Apply style sheets to paragraphs. • Introduction to health and safety in a manufacturing environment. Examples that can be used in class: • Learners create a website to educate people about health and safety in the manufacturing industry. The project must include the following:

<table>
<tr><td></td><td></td><td>- Minimum of two pages.
- Make use of styles.
- Document tags
- Formatting tags
- Colours
- Lists
- Images
- videos</td></tr>
<tr><td>Week 3
(2 hours)</td><td rowspan="3">Algorithms and Coding</td><td>The following Concepts for Algorithms and Coding are revised from previous grades:
• Line based coding
• Flow diagrams
• Data types

The following Concepts for Algorithms and Coding are introduced:
• Introduction to strings
- assigning a string to a variable
- concatenation of strings using the + operator
• Introduction to string functions
- length
- indexing of a character
- substrings
- uppercase and lowercase
• Introduction to lists
- creating a list
- joining two lists using the + operator

Examples that can be used in class:
• Learners create a program that asks the user for their first name and last name, the output of the program must show their full name.
• Learners write a program where they input their name, the program must output their name in capital letters as well as inform the users of the length of their name.
• Learners create and store two lists, and use the + operator to combine their lists.</td></tr>
<tr><td>Week 4
(2 hours)</td><td>The following Concepts for Algorithms and Coding are introduced:
• Introduction to one graphics library
o move forward
o turn left
o turn right
o pen up / pen down
• Introduction to the structure of a for loop
• Continue with lists from previous week
• Continue with strings from previous week

Examples that can be used in class:
• Learners write a program to loop through the items contained within a list.
• Learners write a program to loop through the characters in a string.
• Learners import a graphics library and draw basic polygons using for loops.</td></tr>
<tr><td>Week 5
(2 hours)</td><td>The following Concepts for Algorithms and Coding are introduced:
• Continue with the graphics library from previous week
- move forward
- turn right
- turn left
- pen up / pen down

Examples that can be used in class:
• Learners import a graphics library and draw a combination of basic polygons using for loops.</td></tr>
<tr><td>Week 6
(2 hours)</td><td>Robotics Skills</td><td>The following Concepts for Applications skills are revised from previous terms:
• Different Drawing Tools:
• User interface for a CAD Application.
• Creating and saving drawings
• 2D drawing tools</td></tr>
</table>

		• 3D Extrusion tools • Relate tools • Mechanical: Linkages and Gears The following Concepts for Applications skills are introduced: • Continue with Assembly Drawing (3 Parts) from previous term • Continue creating relationships on parts from previous term • Part Painter • Continue with Linkages and Gears from previous term Example to be used in class. • Learners are provided with mechanical Parts that needs to be drawn as separate parts, saved and the assembled as an assembly drawing. Learners need to create the appropriate relationships between parts in the assembly. The assembly needs to consists of a minimum of 3 parts and paint each part with its own colour.
Week 7 (2 hours)	Robotics Skills	The following Concepts for Robotics are revised from previous terms: • Breadboards • Microcontroller • Basic Electronic Components • Input, Process and Output • Structures • Mechanical Components: - Pulleys - Linkages - Gears The following Concepts for Robotics are introduced: • Structures • Continue with servos from previous terms • Continue with DC motors from previous terms • Continue with LEDs from previous terms • Continue with Sensors from previous terms - proximity sensor - humidity sensor - temperature sensor - light sensor (LDR) Examples that can be used in class: • Learners make the frame for their project based on the planning and requirements for their project. The learners need to place the appropriate electronic components in place where they can.
Week 8 (2 hours)		The following Concepts for Robotics are introduced: • Continue with servos from previous week • Continue with DC motors from previous week • Continue with LEDs from previous week • Continue with Sensors from previous week - proximity sensor - humidity sensor - temperature sensor - light sensor (LDR) Examples that can be used in class: • Learners program a microcontroller based on the planning and requirements for their project and place it on the frame that was built. • Learners complete a Coding and Circuit worksheet for their project.
Week 9 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment Final PAT
Week 10 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment Exams

3.2.3 GRADE 9: TERM 1

WEEK	TOPIC	CONTENT
	Scenario/ Context:	In 2019, Consultancy.co.za reported that South Africa might have been at risk of losing jobs to robots. Currently the ratio between robots and employees is favouring employees but the Country is still in the early stages of automation. According to their analysis the country has 28 industrial robots installed per 10,000 employees, placing it at number 33 in the world. For South Africa, predictions surrounding the loss of jobs have been grave. A recent report from Accenture revealed that nearly 6 million people are currently at risk of losing their jobs to automation. Nevertheless, this figure is subject to change, provided that the workforce upgrades its skills and learns to work in collaboration with machines. The adoption levels of automation are relatively low in South Africa. The country places in the top 40 in the world – which represents a considerable threat nonetheless – but its ratio of 28 robotic installations per 10,000 employees places it fairly low down the list in 33rd place. Engineering News reported in February 2018 that, "There is a lot of local capability in terms of development, but it is not being used," laments Bosscha. "There are lots of people in the CSIR and universities who, if brought together, could make a real impact." The key to a successful outcome is collaboration between researchers, robotics manufacturers and mining companies. But it's needed for the future." "Manufacturers working closely with mining companies are also reluctant to share information – probably to protect the mining companies." It is usually the miners, not the technologists, who resist cooperation. The above-mentioned factors are having a huge impact in Africa, especially in the South African manufacturing industry. Behind the willingness generated by the technological developments, lie issues for society about the impact and effects of this digital transformation. It is important to note that collaborative robots are generating enormous interest in manufacturing industries. What could the future of South Africa hold when Coding and Robotics are truly be synchronised in the manufacturing industry along with Human interaction? • Read the scenario and identify new vocabulary (meaning of new words) • Digest the problem statement and identify possible solutions Practical: (Decomposition and Design): Identify and draft a Design Brief, Specification, and Constraints.
Week 1 (1 hour)	Internet and E - Communication	The following Concepts for Internet and E-communications are revised from previous Grade: • Continue with Cyber Security. • How to safeguard against cyber security attacks. • Biometric authentication. • Multiple levels of security. The following Concepts for Internet and E-communications are introduced: • What is social media? • Why use social media? • Social media platforms. Examples that can be used in class: • Teacher can discuss the social different media platforms and its uses: - Video - Text based - Image - Sound • Learners discuss different social platforms and their media types. • Learners identify different social media platforms using their logos.
Week 1 (1 hour)	Application Skills	The following Concepts for Application Skills are revised from previous grade: • Spread sheets User Interface • Data Types • Cell Formatting

		The following Concepts for Application Skills are introduced: • Absolute Cell references. Examples that can be used in class: • Learners are provided with a hire purchase problem from mathematics. Leaners are provided with the cost, hire purchase interest rate, deposit to be paid as well as the term of the contract. Learners create a worksheet showing the total amount payable, the monthly payment for each month – copying the formulae down to complete the table of monies owed.
Week 2 (2 hours)	Application Skills	The following Concepts for Application skills are revised from previous grade: • Document tags • Formatting tags • Colours • Lists • Images • Hyperlinks • Style sheets • Classes and IDs The following Concepts for Application skills are introduced: • Adding tables to a webpage • Specifying the size of a table • Specifying the width of a column Examples that can be used in class: • Learners create a new web page where they have add a table and fill the contents of the tables.
Week 3 (2 hours)	Algorithms and Coding	The following Concepts for Algorithms and Coding are revised: • Line based coding • Flow diagrams • Data types The following Concepts for Algorithms and Coding are introduced: • Continue with logic gates from previous grade - combining three gates • Continue with truth tables from previous grade Examples that can be used in class: • Teachers provide learners with a worksheet containing various configurations of combinations of three gates and learners will need to complete truth tables to determine possible outcomes of the given gates. • Learners define a list and use a while loop to loop through the list.
Week 4 (2 hours)		The following Concepts for Algorithms and Coding are introduced: • Introduction to the while loop Examples that can be used in class: • Learners define a list and use a while loop to loop through the list. • Learners are presented with a problem involving an infinite loop. Learners need to analyse the given code and make a modification to allow the loop to run a finite number of times.
Week 5 (2 hours)		The following Concepts for Algorithms and Coding are introduced: • Continue to the while loop from previous week • Continue with the for loop from previous week Examples that can be used in class:

		• Learners are provided with basic problems that involve a looping mechanism to solve. Learners will need to apply the correct looping mechanism for the given problem.
Week 6 (2 hours)	Robotics Skills	The following Concepts for Applications skills are revised from previous grades: • Different Drawing Tools: • User interface for a CAD Application. • Creating and saving drawings • 2D drawing tools • 3D Extrusion tools • Relate tools • Mechanical: Linkages and Gears • Assemblies • Part Painter The following Concepts for Applications skills are introduced: • Continue with Assembly Drawing (4 Parts) from previous grade • Continue creating relationships on parts from previous grade • Different display methods. • Mechanical Parts: - Pulleys • Continue with Linkages and Gears from previous grade Example to be used in class. • Learners are provided with mechanical Parts that needs to be drawn as separate parts, saved and the assembled as an assembly drawing. Learners need to create the appropriate relationships between parts in the assembly. The assembly needs to consists of a minimum of 4 parts and paint each part with its own colour. • Learners display their assemblies using different display methods.
Week 7 (2 hours)	Robotics Skills	The following Concepts for Robotics are revised from previous grades: • Breadboards • Microcontroller • Basic Electronic Components • Input, Process and Output The following Concepts for Robotics are introduced: • Continue with potentiometers from previous grade • Continue with servos from previous grade Examples that can be used in class: • Learners program a microcontroller where they have to connect a potentiometers and servo. The movement of the servo will be determined by the output of the potentiometer. • Learners complete a Coding and Circuit worksheet. The Coding and Circuit worksheet must show the connection between components and microcontrollers indicating the relevant code for the circuit that was built and coded.
Week 8 (2 hours)		The following Concepts for Robotics are introduced: • Continue servos (four servos) from previous week • Continue with microcontroller joystick module (two joysticks) from previous grade Examples that can be used in class: • Learners program a microcontroller where they have to connect a four servos and two microcontroller joystick modules. The movement of the servos will be determined by the output of the microcontroller joystick modules. • Learners complete a Coding and Circuit worksheet. The Coding and Circuit worksheet must show the connection between components and microcontrollers indicating the relevant code for the circuit that was built and coded.
Week 9 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment Mini PAT Term 1
Week 10 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment Tests

GRADE 9: TERM 2

WEEK	TOPIC	CONTENT
Week 1 (1 hour)	Internet and E - Communication	The following Concepts for Internet and E-communications are revised from previous term: • What is social media? • Why use social media? • Social media platforms. . The following Concepts for Internet and E-communications are introduced: • Advantages of social media platform - Marketing - Community cohesion • Disadvantages of social media. - Cyber bullying - Fake news • Describe social, ethical and legal issues of social networking Examples that can be used in class: • Teacher facilitates about the advantages, disadvantages, social, ethical and legal issues of social networking. • Teacher can provide learners with examples of both fake and real news, the learners have to determine which fake and real.
Week 1 (1 hour)	Application Skills	The following Concepts for Application Skills are revised from previous term: • Data Types • Formulas. • Order of Operations • Conditional Formatting: - Greater than - Less Than - Between The following Concepts for Application Skills are introduced: • Functions and Boolean Operators: - IF - AND - OR Examples that can be used in class: • Learners are provided with datasheets and have to use the following Functions and Boolean Operators to analyse the Data: - IF - AND - OR • Learners are provided with datasheets and have a combination of Boolean operators with an if statement to find values greater than, less than or in between specific values.
Week 2 (2 hours)	Application Skills	The following Concepts for Application skills are revised from term 2: • Document tags • Formatting tags • Colours • Lists • Images • Hyperlinks • Style sheets • Classes and IDs • Tables The following Concepts for Application skills are introduced: • Formatting of tables. - Table alignment - Table colours.

		- Cell spacing - Cell padding Examples that can be used in class: Learners format the tables they created in term 1. They have to use the following aspects of table formatting. - Table alignment - Table colours. - Cell spacing - Cell padding
Week 3 (2 hours) **Week 4 (2 hours)** **Week 5 (2 hours)**	Algorithms and Coding	The following Concepts for Algorithms and Coding are revised from previous grades: • Line based coding • Flow diagrams • Data types ***The design and the programming of the gaming project must be completed in class.*** The following Concepts for Algorithms and Coding are introduced: • Continue with for loops from previous term - Nested loops (two levels) • Introduction to modular programming - Process flow diagram - Defining and calling functions - Passing one parameter to a function Examples that can be used in class: • Learners use the graphics library to define functions that allow them to draw basic polygons. The size of the polygons should be dependent on the parameter that has been passed to the function. The following Concepts for Algorithms and Coding are introduced: Continue • Continue with lists from previous grade • Introduction of list functions - Appending items to a list - Inserting items into a list - Removing items from a list - Clearing a list • Introduction to list indexing Examples that can be used in class: • Learners are given a worksheet where they need to define a given list. Learners must complete the worksheet using the list functions to add, insert, remove and clear a list. • Learners are given a worksheet with list items. Learners need to use indexing and loop through a given list. The following Concepts for Algorithms and Coding are introduced: Continue • Continue with machine learning from Grade 7 • Introduction to line based machine learning Library Example that can be used in class: • Learners use a machine learning Library to create an application using line based code. (intermediate or advanced). For example, creating a chatbot or an application that determines whether a website is safe for browsing or not.
Week 6 (2 hours)	Robotics Skills	The following Concepts for Applications skills are revised from previous terms: • Different Drawing Tools: • User interface for a CAD Application. • Creating and saving drawings

		• 2D drawing tools • 3D Extrusion tools • Relate tools • Mechanical: Linkages and Gears • Assemblies • Part Painter The following Concepts for Applications skills are introduced: • Export files for 3D Printing. • Continue with Assembly Drawing (5 Parts) from previous terms • Continue creating relationships on parts from previous terms • Continue with different display methods from previous terms • Continue with Linkages, Gears and Pulleys from previous terms Example to be used in class. • Learners are provided with mechanical Parts that needs to be drawn as separate parts, saved and the assembled as an assembly drawing. Learners need to create the appropriate relationships between parts in the assembly. The assembly needs to consists of a minimum of 5 parts and paint each part with its own colour. • Learners display their assemblies using different display methods. • Learners export a Part file for 3D printing.
Week 7 (2 hours)	Robotics Skills	The following Concepts for Robotics are revised from previous grades: • Breadboards • Microcontroller • Basic Electronic Components • Input, Process and Output The following Concepts for Robotics are introduced: • Bluetooth module for a microcontroller • Continue with LEDs from previous grades Examples that can be used in class: • Learners program a microcontroller where they have to connect a Bluetooth module and an LED. The LED should be switched on and off via Bluetooth. • Learners complete a Coding and Circuit worksheet. The Coding and Circuit worksheet must show the connection between components and microcontrollers indicating the relevant code for the circuit that was built and coded.
Week 8 (2 hours)		The following Concepts for Robotics are introduced: • Continue with Bluetooth module for a microcontroller from previous week • Continue with multiple LEDs (at least two) from previous week Examples that can be used in class: • Learners program a microcontroller where they have to connect a Bluetooth module and at least two LEDs. The LEDs should be switched on and off via Bluetooth. • Learners complete a Coding and Circuit worksheet. The Coding and Circuit worksheet must show the connection between components and microcontrollers indicating the relevant code for the circuit that was built and coded.
Week 9 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment Mini PAT Term 2
Week 10 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment Exam

GRADE 9: TERM 3

WEEK	TOPIC	CONTENT
Week 1 (1 hour)	Internet and E - Communication	The following Concepts for Internet and E-communications are revised from previous term: • Advantages and disadvantages of social media. • Social, ethical, and legal issues of social networking The following Concepts for Internet and E-communications are introduced: • What is streaming? • Different types of streaming services. • Uses of streaming services. Examples that can be used in class: • Teacher discusses the different types streaming services: - Video - Music - Online gaming streaming • Teachers shows learners examples of streaming services and it is being used an entrepreneurship tool. • Teacher discusses how streaming services can be used as entrepreneurship tool.
Week 1 (1 hour)	Application Skills	The following Concepts for Application Skills are revised form previous term: • Data Types • Cell Formatting The following Concepts for Application Skills are introduced: • Use Conditional Formatting – Cell Rules: - Equal to - Text - Duplicate Values/Texts Examples that can be used in class: • Learners are provided with datasheets and have to use the following Conditional Formatting Tools to analyse the Data: - Equal to - Text - Duplicate Values/Texts
Week 2 (2 hours)	Application Skills	The following Concepts for Application skills are revised from previous terms: • Document tags • Formatting tags • Colours • Lists • Images • Hyperlinks • Style sheets • Classes and IDs • Tables The following Concepts for Application skills are introduced: • Plan and design a website. • Text based navigation bars - Layout - Design Examples that can be used in class: Learners create a website with three pages that includes:

		• Document tags • Formatting tags • Colours • Lists • Images • Hyperlinks • Style sheets • Classes and IDs • Tables • Videos • a text based navigation bar
Week 3 (2 hours)	Algorithms and Coding	The following Concepts for Algorithms and Coding are revised from previous grades: • Line based coding • Flow diagrams • Data types The following Concepts for Algorithms and Coding are introduced: • Introduction to event driven programming - Using keys to move an object Examples that can be used in class: • Learners import a graphics library which they must code to move using keyboard keys.
Week 4 (2 hours)		The following Concepts for Algorithms and Coding are introduced: • Introduction to game characteristics - types of games - game mechanics - game design • Continue with process flow diagram from previous term Examples that can be used in class: • Teacher to discuss characteristics of games. Learners should provide their input in terms of what constitutes a game. • Learners design a 2D game on paper, and explain the mechanics of their game. The design of the game should include all objects to be used in the game, as well as explain the mechanics of each element of the game.
Week 5 (2 hours)		The following Concepts for Algorithms and Coding are introduced: • Continue with game characteristics from previous week - types of games - game mechanics - game design • Continue with process flow diagram from previous week • Continue with graphics libraries from previous week Examples that can be used in class: • Learners use their 2D design from the previous week and create their objects and backgrounds within the programming interface.
Week 6 (2 hours)	Robotics Skills	The following Concepts for Applications skills are revised from previous terms: • Different Drawing Tools: • User interface for a CAD Application. • Creating and saving drawings • 2D drawing tools • 3D Extrusion tools • Relate tools • Mechanical: Linkages and Gears

		• Assemblies • Part Painter The following Concepts for Applications skills are introduced: • Setup a file for 3D Printing • Continue Exporting files for 3D Printing. • Create a realistic rendering of their Assembly. • Continue with Assemblies from previous term Example to be used in class. • Teacher discusses the printing method used for 3D printing and the pitfalls that needs to be avoided. • Learners finalise a part of their robot to be 3D printed and Print it. • Learners export a Part file for 3D printing.
Week 7 (2 hours)	Robotics Skills	The following Concepts for Robotics are revised from previous grades: • Breadboards • Microcontroller • Basic Electronic Components • Input, Process and Output The following Concepts for Robotics are introduced: • Continue Bluetooth module for a microcontroller from previous term • Continue with DC motor from previous grades Examples that can be used in class: • Learners program a microcontroller where they have to connect a Bluetooth module and a DC motor. The speed and direction of the DC motor should be controlled via Bluetooth. • Learners complete a Coding and Circuit worksheet. The Coding and Circuit worksheet must show the connection between components and microcontrollers indicating the relevant code for the circuit that was built and coded.
Week 8 (2 hours)		The following Concepts for Robotics are introduced: • Continue with Bluetooth module for a microcontroller from previous week • Continue with Servos from previous term Examples that can be used in class: • Learners program a microcontroller where they have to connect a Bluetooth module and a servo. The rotation of the servo should be controlled via Bluetooth. • Learners complete a Coding and Circuit worksheet. The Coding and Circuit worksheet must show the connection between components and microcontrollers indicating the relevant code for the circuit that was built and coded.
Week 9 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment Mini PAT Term 3
Week 10 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment Tests

GRADE 9: TERM 4

WEEK	TOPIC	CONTENT
Week 1 (1 hour)	Internet and E - Communication	The following Concepts for Internet and E-communications are revised from previous terms: • Social media • Streaming • Artificial Intelligence The following Concepts for Internet and E-communications are introduced: • Introduction to Big Data • Analysing of data using AI techniques. Examples that can be used in class: • Teacher explains how online services (social media platforms, Search engines, Location services) collect data, and how this data is analysed through AI to determine trends and patterns in user behaviour. This information is then used in marketing, managing inventories and procurement.
Week 1 (1 hour)	Application Skills	The following Concepts for Application Skills are revised from previous grades: • Data Types • Cell Formatting • Charts • Formulas The following Concepts for Application Skills are introduced: • Charts: - Gridlines - Legends • Continue with Chart Types - Scatter Plots - Line Graph • Continue with Charts: - Create, format and edit - Meaningful titles and labels Examples that can be used in class: • Learners create a spreadsheet with a relational data set. They need to create Charts from the data and add meaningful titles and labels. They need to use the following two types of Charts: - Scatter Plots - Line Graph
Week 2 (2 hours)	Application Skills	The following Concepts for Application skills are revised from previous terms: • Document tags • Formatting tags • Colours • Lists • Images • Hyperlinks • Style sheets • Classes and IDs • Tables The following Concepts for Application skills are introduced: • Continue with website development from previous term • Introduction to health and safety in a manufacturing environment that uses robots. Examples that can be used in class: • Learners create a website to educate people about health and safety in the manufacturing industry while people are working alongside robots. The project must include the following: - Minimum of three pages. - Make use of styles. - Document tags - Formatting tags

		- Colours - Lists - Tables - Navigation Bars - Images - Videos
Week 3 (2 hours)	Algorithms and Coding	The following Concepts for Algorithms and Coding are revised from previous terms: • Line based coding • Flow diagrams • Data types ***The design and the programming of the gaming project must be completed in class.*** The following Concepts for Algorithms and Coding are introduced: • Continue with game characteristics from previous term - types of games - game mechanics - game design • Continue with process flow diagram from previous term • Continue with graphics libraries from previous term Examples that can be used in class: • Learners continue with their game design within the programming interface.
Week 4 (2 hours)		The following Concepts for Algorithms and Coding are introduced: • Continue with game characteristics from previous week - types of games - game mechanics - game design • Continue with process flow diagram from previous week • Continue with graphics libraries from previous week Examples that can be used in class: • Learners complete their game.
Week 5 (2 hours)		The following Concepts for Algorithms and Coding are introduced: • Continue with game characteristics from previous week - types of games - game mechanics - game design • Continue with process flow diagram from previous week • Continue with graphics libraries from previous week Examples that can be used in class: • Learners present their games and discuss their design process.
Week 6 (2 hours)	Robotics Skills	The following Concepts for Applications skills are revised from previous terms: • Different Drawing Tools: • User interface for a CAD Application. • Creating and saving drawings • 2D drawing tools • 3D Extrusion tools • Relate tools • Mechanical: Linkages and Gears • Assemblies • Part Painter The following Concepts for Applications skills are introduced:

		• Continue with 3D Printing from previous term • Continue Exporting files for 3D Printing from previous term • Continue creating a realistic rendering of their Assembly from previous term • Continue with Assemblies from previous term Example to be used in class. • Teacher discusses the printing method used for 3D printing and the pitfalls that needs to be avoided. • Learners finalise a part of their robot to be 3D printed and Print it. • Learners export a Part file for 3D printing. • Learners Create a Realistic render of their Project.
Week 7 (2 hours) **Week 8 (2 hours)**	Robotics Skills	The following Concepts for Robotics are revised from previous terms: • Breadboards • Microcontroller • Basic Electronic Components • Input, Process and Output • Structures • Mechanical Components: - Pulleys - Linkages - Gears The following Concepts for Robotics are introduced: • Structures • Continue with Bluetooth module (or other wireless technology) from previous terms • Continue with servos from previous terms • Continue with DC motors from previous terms • Continue with LEDs from previous terms • Continue with Sensors from previous terms - proximity sensor - humidity sensor - temperature sensor - light sensor (LDR) Examples that can be used in class: • Learners make the frame for their project based on the planning and requirements for their project. The learners need to place the appropriate electronic components in place where they can. The following Concepts for Robotics are introduced: • Continue with Bluetooth module (or other wireless technology) from previous week • Continue with servos from previous week • Continue with DC motors from previous week • Continue with LEDs from previous week • Continue with Sensors from previous week - proximity sensor - humidity sensor - temperature sensor - light sensor (LDR) Examples that can be used in class: • Learners program a microcontroller based on the planning and requirements for their project and place it on the frame that was built. • Learners complete a Coding and Circuit worksheet for their project.
Week 9 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment Final PAT
Week 10 (2 hours)	Evaluation	(Place this in a logical order) Consolidation, Practice and Assessment Exam

SECTION 4: ASSESSMENT IN CODING AND ROBOTICS

4.1 Introduction

Assessment is a continuous planned process of identifying, gathering and interpreting information about the performance of learners, using various forms of assessment.

It involves four steps:

- generating and collecting evidence of achievement;
- evaluating this evidence;
- recording the findings and
- using this information to understand and thereby assist the learner's development to improve the process of learning and teaching.

Assessment should be both informal (Assessment for Learning) and formal (Assessment of Learning). In both cases, regular feedback should be provided to learners to enhance the learning experience.

In Coding and Robotics, throughout the Intermediate Phase, the emphasis in assessment is on both writing and doing practical work using digital devices. This means that learners in the Intermediate Phase are assessed through their written and practical coding projects, written and practical robotics projects, electronic circuits, workbook activities and application skills activities.

Coding and Robotics gives learners an opportunity to explore the Technological and Digital world and to further their understanding of it. Across all four Coding and Robotics Strands, the purpose of assessment is to support and encourage the learners, and to assess the learners' holistic development. We know that learners develop knowledge, skills and values by observing their participation and engagement in activities related to those concepts.

Informal assessment of Coding and Robotics throughout the Senior Phase is conducted on an ongoing basis. One good way to do this is to keep an observation book for the teacher. Anything observed of interest or of concern should be noted in the observation book, and followed up each day. These notes should also be included in planning and preparation for remedial purposes, and can also include future assessments. The forms of assessment should be age and development level appropriate. The design of the tasks should cover the content

of the subject and include a variety of tasks designed to achieve the objectives of that specific subject.

Assessments can be conducted individually, in teams during projects and practical activities. Checklists and rubrics may be used to record assessments. Assessments (formal and informal) will enable the teacher to track and monitor the learner's progress throughout the term.

4.2 Assessment in Coding and Robotics

Learners should be given adequate guidance and support to engage with the test format. Assessment (informal and formal) throughout the Senior Phase entails continuous assessment and tests/examinations.

4.2.1 Informal or Daily Assessment

Assessment for learning has the purpose of continuously collecting information about learner performance that can be used to improve their learning. Informal assessments should include a range of cognitive levels and abilities of learners.

Informal assessment is a daily monitoring of learners' progress. This is done through online classroom quizzes, observations, discussions, practical demonstrations, learner-teacher conferences, informal classroom interactions, etc. Informal assessment may be as simple as stopping during the lesson to observe learners or to discuss with learners how learning is progressing. Informal assessment should be used to provide feedback to learners and to inform planning for teaching but need not be recorded. It should not be separate from the learning activities taking place in the classroom.

Online self, peer and team assessments actively allow learners to assess themselves. This is important as it allows learners to learn from and reflect on their own performance.

4.2.2 Formal Assessment

All assessment tasks that make up a formal programme of assessment for the year are regarded as Formal Assessment. Formal assessment tasks are marked and formally recorded by the teacher for progression and certification purposes. All Formal Assessment tasks are subject to moderation for the purpose of quality assurance and to ensure that appropriate standards are maintained.

Formal assessment provides teachers with a systematic way of evaluating how well learners are progressing in a year and in a subject. Examples of formal assessments can be done physically and online and includes tests, examinations, practical tasks, projects, oral presentations, demonstrations, performances, etc.

4.2.2.1 Formal Assessment Requirements for Coding and Robotics

- School Based Assessment (SBA): SBA, which is written at the end of term 1, 2 and 3, shows the learner's progress throughout the year and accounts for 40% of the learner's promotion mark,
- In Grades 7 and 8 all SBA is set and moderated internally.
- In Grade 9 the formal assessment (40%) is internally set and marked but externally moderated.
- Practical Assessment Task (PAT): PAT accounts for the skills the learner has mastered. This is
- assessed at intervals and requires the learner to engage in multiple practical sessions. During these weekly sessions, skills such as simulation, experimentation, hand, tool, coding, digital and machine skills and workshop practice are honed and perfected to the point where the learner may engage in the tasks set out for that term. The PAT accounts for 20% of the learner's promotion mark.
- In Grades 7- 8 the Practical Assessment Task is set and marked internally but externally moderated.
- In Grade 9 the Practical Assessment Task (20%) is externally set, internally marked and externally moderated.
- End of the examination: At the end of each academic year every learner is required to write a final examination consist of one paper. The Paper covers all the theoretical work covered through the year. This paper counts 20% of the learner promotion mark.
- The end of the year written assessments i.e. PATS, Practical and Theory Examinations (60%) for Grade 9 is externally set, marked and moderated.

4.2.2 Tests and Examinations

Tests and rubrics should be carefully planned, prepared and moderated. Learners should be given adequate support and guidance prior to writing Tests and Exams. In the Senior Phase

for Coding and robotics learners are required to write Tests in Term 1 and 3 and Examinations in Term 2 and 4.

4.2.2.1. Tests

The tests in Term 1 and 3 should be based on the following suggested minimum criteria in Table 4.2.

TERM	TOPICS	GRADE 7			GRADES 8 & 9		Gr8	Gr9
		Hours	Weighting	Marks	Hours	Weighting	Marks	Marks
1&3	Algorithms and Coding	5	31%	16	6	38%	19	23
	Robotics	6	38%	19	6	38%	19	23
	Internet and E-Communication	2	12%	6	1	6%	3	4
	Application Skills	3	19%	9	3	18%	9	10
TOTAL		**16**	**100%**	**50**	**16**	**100%**	**50**	**60**

Table 4.2: Grade 7-9 Test Mark Allocations and Weightings for Terms 1 and 3

Furthermore, Tests need to adhere to the following requirements:

- A theory test for formal assessment should not comprise of a series of small tests but should cover a substantial amount of content and the duration should at least be 60 minutes in grades 7 – 9.
- Each test must accommodate a range of cognitive levels.
- The forms of assessment used should be age and development level appropriate. The design of these tasks should cover the content of the subject and include a variety of tasks designed to achieve the objectives of the subject.

Grades	Tests Term 1 and 3	
	Time Allocation	Mark Allocation
7	60 minutes	50 marks
8	60 minutes	50 marks
9	60 minutes	60 marks

4.2.2.2. Examinations

Examinations consist of one Theory Paper. The Exams in Term 2 and 4 should be based on the following suggested minimum criteria in table 4.3.

Table 4.3: Grade 7-9 Exam mark allocations and weightings for Term 2 and 4.

TERM	TOPICS	GRADE 7			GRADES 8 & 9		Gr8	Gr9
		Hours	Weighting	Marks	Hours	Weighting	Marks	Marks
2 & 4	Algorithms and Coding	5	31%	19	6	38%	30	38
	Robotics	6	38%	22	6	38%	30	38
	Internet and E-Communication	2	12%	8	1	6%	5	6
	Application Skills	3	19%	11	3	18%	15	18
TOTALS		16	100%	60	16	100%	80	100

Table 4.3: Grade 7-9 Exam Mark Allocations and Weightings for Terms 2 and 4.

Examination time allocation in Coding and Robotics will be as follows:

Grades	Examination	
	Time Allocation	Mark Allocation
7	90 minutes	60 marks
8	90 minutes	80 marks
9	120 minutes	100 marks

All question papers set by the teacher throughout the year, including the November paper must be scrutinized by the head of department at the school and approved by the Coding and Robotics facilitator for the district. In the Grade 9 examination only Grade 9 content will be assessed. However, prior knowledge from Grades 7- 8 may be necessary to interpret and answer some of the questions.

4.2.3 Practical Assessment Tasks (PAT)

Practical Assessment Tasks involves projects and practical exercises that learners will complete throughout the year. Learners will complete mini PATS during the year and this will contribute to the learner's final mark as follows:

- Term 1-3: 60% of Term SBA mark in each term
- Term 4: 60% of the Final Mark

The Term 1-3 mini PATS will be set internally by the teacher and contributes towards the SBA together with Term 1 and 3 tests and the exams from Term 2. The mini PATs should be completed throughout the term to ensure that it covers the work being taught in the term and at the end of the Term they make up the Mini PAT.

The Term 1-3 mini PAT's should require the learner to:

- Perform the task/carry out instructions (per criteria given)
- The mini PAT should be based all 4 strands of the coding and robotics curriculum.

The Term 4 PAT will serve as the final project for learners in Grades 7-9 and contribute towards the final together with the Term 4 exams. The Term 4 PAT for Grade 9 is set by the Department of Basic Education and the Term 4 PAT for Grades 7- 8 is set internally by the teacher. The Term 4 PAT is the Final Project and should cover the Coding and Algorithms, Robotics and Application Skills Term 4 Topics, where content from previous Terms for Internet and E-Communication may be included.

The Term 4 PAT should require the learner to:

- Plan/prepare/investigate/research to solve the identified problem/task
- Perform the task/carry out instructions (per criteria given)
- Develop the project per the given criteria
- Allow for some innovation and creativity.
- The PAT should be based all 4 strands of the coding and robotics curriculum.

Topics	Term 1 -3	Term 4
	Weighting	Weighting
Algorithms and Coding	20%	20%
Robotics	25%	25%
Application Skills	10%	10%
Internet & E-communications	5%	5%
TOTALS	**60%**	**60%**

To set the different Term PATs, the teacher should:

- Determine the content/skills/knowledge to be addressed
- Set clear criteria and give extensive instructions to guide the learner (the learner should know exactly what to do and what is expected)
- Keep the scope manageable
- Determine which resources will be required to complete the project and ensure that learners have access to these resources
- Determine the time frame/duration/due date
- Determine mark distribution and compile an assessment tool.

4.2.4 Cognitive Levels of Assessment

Formal and Informal assessments should cater for a range of cognitive levels and abilities of learners as shown below:

Cognitive Levels	Percentage of Task
Lower Order: Knowledge	40%
Middle Order: Comprehension and Application	40%
Higher Order: Analysis, Evaluation and Synthesis	20%

4.3 Inclusion

The Screening, Identification, Assessment and Support (SIAS) provides a policy framework for the standardisation of the procedures to identify, assess and provide programmes for all learners requiring support to enhance their participation and inclusion in schools. Planning assessment for Intermediate Phase learners requires teachers to be sensitive to learners experiencing barriers to learning that may prevent them from performing at their best. Learners experiencing barriers to learning must be provided with differentiated opportunities of assessment. These learning barriers may be “contextual”, “systemic”, “individual”, and “pedagogic”. They will have had different educational experiences up to that point, and acquired different skills. The teacher needs to identify each learner’s needs through formal and informal assessment. It may be necessary to allow some learners to catch up and other learners to do extension activities. Based on on-going assessment, the teacher is expected to accommodate all learners in programmes of learning and assess that.

Like all teaching and learning, assessment needs to be inclusive in its approach to assessing learners’ performance. Inclusivity is a central principle of the NCS (White Paper 6), so it is critical that alternative forms of assessment are planned around the different needs and learning styles displayed by learners.

4.4 Assessment across the Senior Phase

The Programme of Assessment is designed to spread formal assessment tasks in Coding and Robotics in a school throughout a term. Without this programme, tests and tasks are crowded into the last few weeks of the term creating unfair pressure on the learners.

4.4.1. Programme of Assessment (PoA) Grade 7-9

	Formal School-Based Assessments			Final End-of-Year Assessments
	Term 1	**Term 2**	**Term 3**	**Term 4**
Grade 7- 9	Mini PAT 60%	Mini PAT 60%	Mini PAT 60%	Final PAT 60%
	Theory Test 40%	Theory Exam 40%	Theory Test 40%	Theory Examination 40%
Term Report	100%	100%	100%	100%
End of Year	School Based Assessment (SBA) = 75%			Consolidated Term 4 Weighting (CTW) = 25%
Promotion /Progression	SBA + CTW = Promotion/ Progression 75% + 25 % = 100%			

4.5 Moderation of Assessment

Moderation refers to the process that ensures that the assessment tasks are fair, valid and reliable. Moderation should be implemented at school, district, provincial and national levels. Comprehensive and appropriate moderation practices should be in place for the quality assurance of all subject assessments.

4.5.1 Mini PAT and PAT Moderation

Moderation of each term's Project phase can start as early as the following term i.e. mini-PATs can be moderated at the end of the second term. The Project will only be moderated upon completion.

The moderation process is as follows:

- During moderation learners are selected at random to demonstrate the completion of the different Project phases.
- Learners being moderated will have access to their completed Project during moderation and may refer to their different Project phases completed earlier in the year.
- Learners may not ask assistance from other learners during moderation.
- All Projects must be on display for the moderator.
- The moderator will select at random no less than two Projects; which learners should explain (how the Project was manufactured).

- Where required, the moderator should be able to call on the learner to explain the Programs function, principles of operation and request the learner to exhibit the skills acquired through the Coding.
- Upon completion, the moderator will, if needed, adjust the marks of the group up or downwards, depending on the decision reached because of moderation.
- Normal examination protocols for appeals will be adhered to if a dispute arises from adjustments made.

4.5.2 SBA Moderation

Moderation of practical and theory tests and examinations shall be conducted by the subject facilitator/or a peer teacher. Grade 7 and 8 tasks are internally moderated except for the PAT that is externally moderated. The subject advisor must moderate a sample of these tasks during school visit, to verify the standard of the internal moderation. Moderation requires the re-marking of the learners work to ensure assessment by the teacher is correct.

Grade 6 tasks should be moderated by the District/Provincial Subject Advisor. This process will be managed by the Provincial Education Department. School-based moderation by the HOD requires the HOD to check the following:

Learner Compliance:

- **Work done by learners comply with the following requirements**:
  - Date
  - Topic
  - Homework assignments reflecting a textbook page and exercise reference
  - Learner scripts are required to show scrutiny and interaction from the teacher in red pen.
  - All teacher actions/interventions in the script must be dated
  - Learners are required to mark all self-assessments in pencil and all corrections to be shown in pencil.

- **Safety:**
  - Learners are required to dress (PPE) appropriately when entering the Robotics Lab.
  - Personal safety should be adhered to
  - Learner conduct in the Robotics Lab must be orderly and appropriate

- Learners are required to enact safety drills, practise safe operating procedures, perform
  housekeeping tasks and assist in Robotics Lab preventative maintenance such as cleaning,
  painting, sanding, etc.

- **Practical Assessment Tasks/Session in Robotics Laboratories:**
  - Learners are required to actively engage in Practical Assessment Tasks, assignments, simulations and experiments
  - Learners who are un-cooperative will receive de-merits or a zero-mark allocation for the section of work
  - Learners who act unsafely in the Robotics Lab, placing other learners in danger, will be removed from the Robotics Lab and should perform additional tasks/engage in corrective behaviour tasks to show improvement in safety awareness and skill. This will be done outside of normal contact time.

Teacher Compliance:

- **Preparation done by teacher includes:**
  - Keeping to pace setters/work schedule
  - Work schedule dates are planned and achieved dates are indicated
  - Lesson plans for each topic
  - Lesson plans and dates in learners' books are aligned.
- Worksheets/tasks/homework assignments in lesson planning aligns with learners' books.
- Work is done every day in the learners' books.
- Workbooks are regularly checked and dated by the teacher.
- Tests have memorandums before they are written.
- Examinations and major tests are moderated by a peer teacher/HOD/facilitator from District.

- **Workshop/Laboratory Management**
  - Storeroom is indexed, neat and clean
  - Inventory is kept up to date every term
  - Robotics Lab is clean and neat
  - Preventative maintenance schedule is drawn up

- Robotics Lab budget is prepared and ready.
- Procurement schedule for Practical and consumable items are kept up to date
- Replacement of old equipment is planned and rolled out.

- **Classroom Management**
  - Classroom is neat and clean
  - Posters and exhibits are evident
  - Pin boards are neatly populated
  - Teacher workstation/desk is neat and clean
  - Filing is neat and tidy.

4.6 Practical Assessment Task (PAT)

The Department of Basic Education issues a Project Guideline for Grade 9 every year. The format of the Grade 9 Project Guideline is duplicated for Grades 7 - 8.

As part of the Project the scenarios. These scenarios are set in the following contexts:

Topics	Grade 7	Grade 8	Grade 9
Projects (PATs)	**Navigation Robot:** Design Process - IDMEC	**Mobile Articulating Robot:** Computational thinking	**Automation of Manufacturing Process:** Design Process and Computational thinking

In all grades, each learner must do a Project Assessment Task for the year

- Grades 7-8: Teachers will set and assess the Project and it will be moderated externally by the subject specialists.
- Grade 9: The Project Assessment Tasks for Grade 9 will be assessed by the teacher and will be
- externally moderated by the District/Provincial subject specialists.
- The date for the external moderation will be decided by the province in which the school is situated.
- The provincial education departments or schools may not change or use the task of the previous year.
- Providing the resources for the Project is the responsibility of the school and schools should ensure that adequate time and funding is allocated for the completion of the Project.

Project sessions should be scheduled in such a way that learners have enough time to practise skills needed for the completion. Weekly practice sessions are needed for the learner to hone the needed skills. A guideline of one (1) hours per week is given for Grades 7 - 8.

Each scenario consists of several activities which will combine to form the Project mark. Owing to the nature of a Project, the scenario chosen by the teacher for the school, may not necessarily tie up with the topic being taught at a time.
In cases where the Grades 7-8 Project and topics are set by the teacher internally, the Head of Department at the school and Coding and Robotics District Subject Advisor are required to approve each task before it is implemented in the Coding and Robotics workshop or laboratory.

Provinces may opt to develop Project guidelines for Grades 7-8 to ensure a unified curriculum approach. These guidelines may however not contradict the design principles outlined in the Grade 9 Project guideline.

The compilation of the Project mark is detailed in the table below:

Description	Time Frame	Weighting of Final 20%	Marks
Mini-PAT	Term 1	3%	20
Mini-PAT	Term 2	3%	20
Mini-PAT	Term 3	3%	20
PAT	Term 4	3.5%	20
Total		**12.5%**	**80**

4.7 Recording and Reporting

Recording is a process in which the teacher documents the level of a learner's performance and progress towards the achievement of the knowledge as prescribed in the Curriculum and Assessment Policy Statements. Records of learner performance should provide evidence of the learner's progression within a grade and her /his readiness to progress to the next grade.

Reporting is a process of communicating learner performance to learners, parents, schools, and other stakeholders. Learner performance can be reported in several ways, including report cards, parents' meetings, school visitation days, parent-teacher conferences, phone calls, letters, class or school newsletters, etc.

Codes and Percentages for Recording and Reporting

Rating code	Description of competence	Percentage
7	Outstanding achievement	80 - 100
6	Meritorious achievement	70 - 79
5	Substantial achievement	60 - 69
4	Adequate achievement	50 - 59
3	Moderate achievement	40 - 49
2	Elementary achievement	30 - 39
1	Not achieved	0 - 29

Note: The seven-point scale should have clear descriptors that give detailed information for each level.

Teachers will record actual marks against the task by using a record sheet; and report percentages against the subject on the learners' report cards.

Assessments are recorded and reported to parents. It is not necessary to keep a formal record of all learner's work. It is useful, however, to keep some work that can show progress over time. Teachers can give learners a choice ofkeeping work that gives a good indication of the learner's abilities at a time. These can be kept in files, and displayed during parent interviews and evenings. Otherwise, learners' work should be displayed in the classroom. At certain points learners, can take their work home after it has been evaluated so that the classroom does not become cluttered.

Record Keeping

Learner evidence can include;

- class workbooks,
- worksheets,
- posters,
- projects,
- for items, such as practical demonstrations,
- presentations and
- models, etc.

It is important that teachers should record comments in the observation book or assessment record sheets. This collection of evidence, together with other assessment tools such as

checklists, observation sheets, etc., will enable the teacher to track and report systematically to the relevant stakeholders on the learner's progress and achievement throughout the year. The collection of learner evidence should be accessible to the relevant stakeholders (School Management Team, parents, guardians, Education Support Services).

Observation book

Teacher observation is one of several types of assessment techniques recommended as part of instruments used for Assessment and Reporting on learner performance. Other assessment techniques include consultation, focused analysis, peer assessment and self-assessment. Observation involves teachers in observing learners as they participate in planned activities. Teacher observation occurs continually as a natural part of the learning and teaching process and can be used to gather a broad range of information about students' demonstrations of learning outcomes.

All teachers are expected to keep a Portfolio of Evidence. The portfolio may be a file, folder or any other storage system that the school has agreed on. Items that should be kept in the teacher's portfolio are:

- Assessment activities and memoranda
- Programme of Assessment;
- Assessment recording sheets;
- Assessment Tools (checklists, observation sheets, rubrics, etc.)

Assessment Record Sheet

Teachers' records of learner progress should be kept either electronically (on a computer) or in files, books or folders or any other form the school has agreed on. These record sheets should have the following information.

- Annual Teaching Plans
- Grade and class
- Learners' names
- Date of assessment task
- The form of assessment and short description of the assessment task
- The final rating that has been awarded to the learner

Comments for support purposes when and where appropriate. The final or overall rating which is awarded to a learner for Coding and Robotics should give a holistic picture of the learner's achievement. The final rating is based on all the formal assessment tasks that the learner has been assessed on in a term. Other relevant factors (like the development of the learner over time) should also be considered.

Reporting in Senior Phase: Grade 7 to 9

Teachers and the school need to be accountable to learners, parents, the education system and the wider community. Being accountable means that schools are required to give feedback to parents on their children's progress and performance using a formal reporting instrument such as a report card. Report cards should be sent to parents and guardians once a term.

In addition to the report cards, schools are expected to use other reporting mechanisms such as:

- parents' meetings
- school visitation days
- parent-teacher conferences
- phone calls
- letters
- school newsletters

Different platforms including digital platforms can be used to report to parents and guardians on a regular basis. This will allow parents/ guardians to remain involved and participate in their children's education.

4.8 General

This document should be read in conjunction with:

4.8.1 National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R-12; and

4.8.2 National Protocol for Assessment Grades R-12,

4.8.3 White Paper 6 on Special Needs Education: Building an Inclusive Education and Training System (2001),

4.8.4 Guidelines for Responding to Diversity in the Classroom through the Curriculum and Assessment Policy Statements (2011),

4.8.5 Guidelines to Ensure Quality Education and Support in Special Schools and Special School Resource Centres (2013),

4.8.6 Policy on Screening, Identification, Assessment and Support (2014),

4.8.7 Guidelines for Full-service/Inclusive Schools (2010), and

4.8.8 Standard Operating Procedures for Assessment of Learners who Experience Barriers to Assessment (2016).

SECTION 5:

RESOURCES

ANNEXURE A: Exemplar of a Holistic Rubric

LEVEL	DESCRIPTION	MARKS
1 **0-19 %**	Learner could not complete model/ no assembly of robot parts / no evidence of research on problem statement done/ no identification of different parts / no evidence of logic sequence developed/ no code written based on logic sequence/ needs intensive help and motivation/ robot and code incomplete	1-11
2 **20-49%**	Learner was able to complete the model/ model not very neat but attempted effort to complete it/ very little research done/ signs of basic logic sequence developed/ no inputs and outputs identified/ coding basic are completed but not running.	12-29
3 **50-79%**	Learner was able to complete the model/ model is neat and completed/ research done on problem statement only using one source/ signs of logic sequence developed/ inputs and outputs identified/ coding basic are completed and working.	30-47
4 **80-100%**	Learner were very creative and very good skills applied to complete the robot model/ model is neat and according to the design/ in-depth research done on the research problem using more than 3 sources/ complete logic sequence developed along with input and output identified/ code is developed and works without problems and does more than required.	48-60

ANNEXURE B: Exemplar of an Analytic Rubric

LEVEL and %	1 (0-19)	2 (20-49)	3 (50-79)	4 (80-100)	MARK OBTAINED
Marks	**0, 1, 2**	**2, 3, 4, 5**	**5, 6, 7, 8**	**8, 9, 10**	
Design Process (10)	There is no evidence of Investigation, Design, Make, Evaluation and Communication	There is very little evidence of Investigation, Design, Make, Evaluation and Communication (minimum of 1 aspect identified in each category)	There is enough evidence of Investigation, Design, Make, Evaluation and Communication (minimum of 3 aspects identified in each category)	There is ample evidence of Investigation, Design, Make, Evaluation and Communication (minimum of 5 aspects identified in each category)	
Computational Thinking (10)	There is no evidence of Decomposition, Pattern recognition, Algorithm Design or Abstraction.	There is very little evidence of Decomposition, Pattern recognition, Algorithm Design or Abstraction (minimum of 1 aspect identified in each category)	There is enough evidence of Decomposition, Pattern recognition, Algorithm Design or Abstraction. (minimum of 3 aspects identified in each category)	There is ample evidence of Decomposition, Pattern recognition, Algorithm Design or Abstraction. (minimum of 5 aspects identified in each category)	
Identification of Components (10)	No components were identified.	Some components were identified (max of 3)	All components were identified.	All components were identified, and their working could be explained.	
Circuit assembly (10)	The circuit diagram couldn't be read with no circuit completed. Extensive help provided.	The circuit diagram could be read to some extent and there is a basic circuit with a few components connected, but still incomplete. Help was provided.	Learners could read the circuit diagram and assemble the circuit correctly with very little assistance.	Learners could read and understand the circuit diagram, build and assemble the circuit correctly without any help provided.	
Flow Diagram of Logic process (10)	There was no Flow Diagram of the logic process and learners	There is a very basic Flow Diagram of the logic process.	There is a complete Flow Diagram of the Logic Process.	There is through and detailed Flow Chart of the logic process.	
Code Design and functionality (20)	There is no code	The basic elements of the code is there but the code is incomplete and doesn't work.	The code is complete and works.	The code is complete and has additional features over and above the minimum required design.	
Model Design and Assembly (10)	Measuring poor/ parts not in proportion based on design. Assembly not completed	Effort attempt to measure but parts sometimes too big or to small and not according to the design Some assembly completed with parts in the incorrect position.	Measuring fairly done to good based on the design. Assembly is complete but some parts are cause problems in the movement of the robot.	Measuring correctly done and very accurate according to the design. Assembly is complete and no problems found in the functional movement of parts.	
Uploading of code to robot/ Connecting to robot (10)	Learners couldn't upload or connect to the robot and extensive help was needed.	Learners could connect the physical connections but could upload the code and some help was required.	Learners could connect and upload codes to the robots with very little assistance.	Learners could connect and upload code on their own without any assistance	
Final Project (10)	The robot didn't work and couldn't complete the objective given in the project. Extensive help had to be provided.	The robot didn't work, but some aspects of the project could be completed with some help.	The robot worked and could complete the objective of the project with very little help provided.	The robot worked and could complete the objective without any help provided to the learners.	

ANNEXURE C: Recording and Reporting Tool

NO	SURNAME AND NAME	TASK & FORMAL ASSESSMENT	TERM 1					TERM 2						TERM 3					SBA	TERM 4						PROMOTION MARK	PROMOTION %	LEVEL	COMMENTS
			Project -Phase 1	Project Moderated Mark	*Test	Term Mark	****Term - Formal Assessment Task 1	Project – Phase 2	Practical Examinations	**Examination	Term Mark	Term Moderated Mark	*****Term Formal Assessment Task 2	Project – Phase 3	Project Moderated Mark	*Test	Term Mark	*****Term - Formal Assessment Task 3	T1 + T2 + T3 (TOTAL)	Project – Final Phase	Final Phase Moderated Mark	Practical Examinations	Test/Examination	****Term - Formal Assessment Task 4	Term Moderation Mark	SBA + ***CTW / ****EA			
		Date																											
		Marks																											

Codes: *** Test** - Theory / Practical as per accommodations in the Concession guidelines and approvals
**** Examination** - Theory/Practical as per accommodations in the Concession guidelines and approvals
***** CTW** - Consolidated Task Weight (Term 4 Assessment Tasks calculations)
****** EA** - External Assessment as per quality assurance body guidelines
******* Term Formal Assessment Task -** Percentage of the term mark

ANNEXURE D: School Moderation Tool

NAME OF SCHOOL:				
SUBJECT:				
GRADE:				
NAME OF TEACHER(S)				
TERM:	**1**	**2**	**3**	**4**

TEACHER FILE	**YES**	**NO**	**COMMENTS**
Educators file well-arranged and neatly organized**.**			
Programme of assessment included			
Annual teaching plan included			
Formal assessment tasks and memoranda			
Marking tool/rubrics/guide of all the completed formal tasks have been included			
Recording sheet/mark sheets included			
Pre-moderation tool included			
Number of tasks completed:			
MARKING ASSESSMENT OF TASKS/TESTS	**YES**	**NO**	**COMMENTS**
Was marking / assessment of task done according to the assessment tools prepared?			
Is marking consistent?			
Have learners responded to the questions correctly			
Is the quality of marking acceptable			
Is there evidence of intensive marking where the teacher considers and accepts learner opinion with valid reasons			
Are marks in task/test correctly added?			
The mark given compares well with the performance of the learners			
Is there evidence of teacher feedback included with learner's assessment task/test?			
RECORDING	**YES**	**NO**	**COMMENTS**
Is the recording tool available in the teacher's file?			
Are marks for all the completed tasks/tests recorded?			
Do the learners' marks correspond with those recorded on the tool?			
Are marks correctly converted if required?			
Do all learners have marks recorded against all the tasks/tests?			
Are there learners with zero mark?			
LEARNER SUPPORT	**YES**	**NO**	**COMMENTS**
If the learner has not achieved, is there evidence of expanded opportunities / alternative forms of assessment / support tasks given?			

NAMES OF LEARNERS WHO'S TASKS WERE MODERATED

NAMES	EDUCATOR'S MARKS	MODERATOR'S MARKS	MARKS ADJUSTED
1.			
2.			
3.			
4.			
5.			
6.			

REASONS TO ADJUST MARKS:

_____

_____

_____

COMMENTS ON THE STANDARD AND QUALITY OF MARKING, GOOD PRACTICE AND BRIEF SUGGESTIONS FOR IMPROVEMENT:

_____

_____

_____

_____

SIGNATURE OF HOD/ MODERATOR: _____

DATE : _____

SCHOOL STAMP

ANNEXURE E: Moderation Instrument before Administering the Test

NAME OF SCHOOL :_____

DATE : _____

SUBJECT :_____

GRADE : _____

EXAMINATION/TEST :_____

NAME OF MODERATOR: _____

TERM : _____

CRITERION 1: LAYOUT OF THE PAPER

LAYOUT OF THE PAPER	Y	N	Comments
1.1 The question paper is complete with relevant marking grid and memorandum			
1.2 The cover page has all relevant details such as time allocation, name of the subject and instructions to candidates			
1.3 The instructions to candidates are clearly specified and unambiguous			
1.4 The layout of the paper is candidate friendly			
1.5 The paper has the correct numbering			
1.6 Appropriate fonts are used throughout the paper			
1.7 Mark allocations are clearly indicated			
1.8 The paper can be completed in the time allocated			
1.9 The mark allocation on the paper is the same as that on the memo			
1.10 The paper adheres to the format requirements in the CAPS			
1.11 Is the test free of spelling/grammatical errors			

CRITERION 2: CONTENT COVERAGE

CONTENT COVERAGE	Y	N	Comments
2.1 The paper adequately covers topics/skills & knowledge as prescribed in the CAPS document.			
2.2 The questions are within the broad scope of the CAPS document.			
2.3 The paper covers questions of various types e.g. multiple choice questions, matching, scenarios, case studies and essay-type questions according to the CAPS document.			
2.4 The paper allows for the creative responses from learners			
2.5 The examples and illustrations are suitable, appropriate, relevant and academically correct			
2.6 There is correlation between mark allocation, level of difficulty and time allocation			

CRITERION 3: COGNITIVE SKILLS

COGNITIVE SKILLS	Y	N	Comments
3.1There is an appropriate distribution of questions in terms of cognitive levels (Bloom's taxonomy), (Barrett taxonomy& Tarrets Taxonomy) to assess the following: - reasoning ability - ability to compare and contrast Adapt according - ability to see causal relationship to subject - ability to express argument clearly specific - ability to see causal relationship - ability to express argument clearly			
3.2 Choice questions are of an equal level of difficulty			
3.3 There is a correct distribution of marks according to the norms			

CRITERION 4: MARKING GUIDELINE -MEMORANDUM/TOOL/INSTRUMENT

MARKING GUIDELINE - MEMORANDUM/TOOL/INSTRUMENT	Y	N	Comments
4.1 The marking memorandum is accurate			
4.2 It corresponds with the questions in the paper			
4.3 The memo makes allowance for alternative responses			
4.4 The marking memo is laid out clearly and neatly typed			
4.5 The marking memo is complete with mark allocation and distribution within the questions.			

CRITERION 5:

ADHERENCE TO ASSESSMENT POLICIES/GUIDELINE DOCUMENTS	Y	N	Comments
5.1The question paper is in line with the current policy/ guideline document, CAPS and supporting documents.			
5.2 The paper reflects the prescribed topics/skills & knowledge – as in NCS/CAPS			
5.3 The weighting and spread of the topics is appropriate as NCS/ CAPS			

CRITERION 6: OVERALL IMPRESSION

	Y	N	Comments
6.1 The question paper is fair, valid and reliable			
6.3 The question paper is of appropriate standard			
6.4There is a balance between the assessment of skills, knowledge and values			
6.5 The paper is in line with the relevant current policy/guideline documents			

OVERALL IMPRESSION OF THE TEST/EXAM

DECISION	YES	NO
The test/exam is approved		
The test/exam is provisionally approved and needs some adjustments		
The test/exam is not approved and must be re-submitted on the following date for re-moderation and approval:		

Comment/s

_____

_____

_____

_____

_____

Checked by: ……..

Sign : ……

Date

SCHOOL STAMP

:……..

GLOSSARY:

APPLICATION SKILLS

CONCEPTS	DEFINITIONS
Application	An application, or application program, is a software program that runs on your computer. Web browsers, e-mail programs, word processors, games, and utilities are all applications
Column	On a display screen in character mode, a column is a vertical line of characters extending from the top to the bottom of the screen
Computing device	A computer is a. device for working with information. The information can be numbers, words, pictures, movies, or sounds
Desktop	Desktop personal computers, or pcs, are used for tasks at the office, at school, and at home
Difference	Differing from all others; not the same
Digitally compile	To gather together: to compile data digitally
Graphics	A picture, map, or graph used for illustration
Graphics editing application	A program or collection of programs that enable a person to manipulate images or models visually on a computer
Grid/matrix	Rectangular grids, or sheets, that are made up of columns, rows, and cells
Keyboard	A computer keyboard is an input device that allows a person to enter letters, numbers, and other symbols (these are called characters) into a computer.
Programs	A set of step-by-step instructions that tell a computer to do something with data
Row	A series of persons or things arranged in a usually straight line Especially: a horizontal arrangement of items
Sequence	A continuous or connected series
Similarities	When something is the same
User interface (UI)	A program that controls a display for the user (usually on a computer monitor) and that allows the user to interact with the system
Word processing	The means by which information is transformed into a typed or printed page is called word processing. Word processing involves the use of computers, software, and printers to get data into printed form

CODING AND ROBOTICS

CONCEPT	DEFINITION
Algorithms	A process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer.
Computational abstraction	Once we have recognised patterns in our problems, we use abstraction to gather the general characteristics and to filter out of the details we do not need in order to solve our problem.
Copyright	Copyright is the exclusive right given to the creator of a creative work to reproduce the work, usually for a limited time.
Cyber bullying	Cyberbullying is bullying that takes place over digital devices like cell phones, computers, and tablets. Cyberbullying can occur through SMS, Text, and apps, or online in social media, forums, or gaming where people can view, participate in, or share content. Cyberbullying includes sending, posting, or sharing negative, harmful, false, or mean content about someone else.
Debug	The process of identifying and removing errors from computer hardware or software.
Design principles	Design Principles are fundamental points of advice for making easy-to-use, pleasurable designs as we select, create and organize elements and features in our work.
Digital citizenship	Digital citizenship refers to the responsible use of technology by anyone who uses computers, the Internet, and digital devices to engage with society on any level.
E-communication	E-communication, or electronic communication, refers to the transfer of writing, signals, data, sounds, images, signs or intelligence sent via an electronic device. Some examples of e-communication are email, text messages, social media messaging and image sharing.
Ethical	Relating to moral principles or the branch of knowledge dealing with these.
GUI	Graphical User Interface - A GUI (graphical user interface) is a system of interactive visual components for computer software. A GUI displays objects that convey information and represent actions that can be taken by the user. The objects change colour, size, or visibility when the user interacts with them.
Screen time	Time spent using a device such as a computer, television, or games console.
Sprite/ character	Blocks are puzzle-piece shapes that are used to create code. The blocks connect to each other vertically like a jigsaw puzzle, where each data type has its own shape and a specially shaped slot for it to be inserted into, which prevents syntax errors. Series of connected blocks are called scripts. A few categories of blocks: Motion, Looks, Sound, Event, Control, Sensing, Operators, Variables, List, and My Blocks. The list blocks are shown under the Variables Blocks.

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

Acronyms and Abbreviations	Meanings
FOSS	Free Open Source Software
GETC	General Education and Training Certificate
GETC:TO	General Education and Training Certificate: Technical Occupational
GETC:TV	General Education and Training Certificate: Technical Vocational
GUI	Graphical User Interface
I/O	Input-Output
ICT	Information and Communication Technology
IDMEC	Investigation, Design, Make, Evaluate, Communicate
IP	Internet Protocol
IPO	Input-Processing-Output
OHS	Occupational Health and Safety
PAT	Practical Assessment Task
PoA	Programme of Assessment
PoE	Portfolio of Evidence
RAM	Random Access Memory
ROM	Read-Only Memory
SBA	School Based Assessment
SSD	Solid State Hard drive
URL	Uniform Resource Locater
USB	Universal Serial Bus
VoIP	Voice over Internet Protocol
VPN	Virtual Private Network
WAN	Wide Area Network
Wi-Fi	Wireless Fidelity
WWW	World Wide Web