



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

CURRICULUM AND ASSESSMENT POLICY STATEMENT

(CAPS)

TECHNOLOGY GRADES 7-9

FINAL DRAFT

SECTION 1

National Curriculum and Assessment Policy Statement for Technology Grades 7-9

1.1 Background

The *National Curriculum Statement Grades R – 12 (NCS)* stipulates policy on curriculum and assessment in the schooling sector.

To improve its implementation, the National Curriculum Statement was amended, with the amendments coming into effect in January 2011. A single comprehensive Curriculum and Assessment Policy document was developed for each subject to replace the old Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines in Grades R - 12.

The amended *National Curriculum Statement Grades R - 12: Curriculum and Assessment Policy (January 2011)* replaces the *National Curriculum Statement Grades R - 9 (2002)* and the *National Curriculum Statement Grades 10 - 12 (2004)*.

1.2 Overview

- (a) The *National Curriculum Statement Grades R – 12 (January 2011)* represents a policy statement for learning and teaching in South African schools and comprises the following:
 - (i) Curriculum and Assessment Policy documents for each approved school subject as listed in the policy document *National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF)*; and
 - (ii) The policy document *National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF)*.
- (b) The *National Curriculum Statement Grades R – 12 (January 2011)* should be read in conjunction with the following documents:
 - (i) 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 Grade R – 12*, published in the *Government Gazette*, No. 29467 of 11 December 2006; and
 - (ii) 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 the *Government Gazette*, No.29466 of 11 December 2006.
- (c) The Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines for Grades R - 9 and Grades 10 - 12 are repealed and replaced by the *Curriculum and Assessment Policy documents for Grades R – 12 (January 2011)*.
- (d) 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* and 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 what is regarded to be knowledge, skills and values worth learning. It will ensure that learners acquire and apply knowledge and

skills in ways that are meaningful to their own lives. In this regard, the curriculum promotes the idea of grounding 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-fulfilment, and meaningful participation in society as citizens of a free country;
- providing access to higher education;
- facilitating the transition of learners from education institutions to the workplace; and
- providing employers with a sufficient 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 our 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 sets 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 10 – 12 (General) 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 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 and/or language skills in various modes;
- use science and technology effectively and critically showing responsibility towards the environment and the health of others; and
- demonstrate an understanding of the world as a set of related systems by recognising that problem solving contexts do not exist in isolation.

(e) Inclusivity should become a central part of the organisation, planning and teaching 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.

1.4 Time Allocation

1.4.1 Foundation Phase

- (a) The instructional time for subjects in the Foundation Phase is as indicated in the table below:

Subject	Time allocation per week (hours)
I. Home Language	6
II. First Additional Language	4 (5)
III. Mathematics	7
IV. Life Skills	6
• Beginning Knowledge	1 (2)
• Arts and Craft	2
• Physical Education	2
• Health Education	1

- (b) Instructional time for Grades R, 1 and 2 is 23 hours. For Grade 3, First Additional Language is allocated 5 hours and Beginning Knowledge is allocated 2 hours as indicated by the hours in brackets in the table above.

1.4.2 Intermediate Phase

- (a) The table below shows the subjects and instructional times in the Intermediate Phase.

Subject	Time allocation per week (hours)
I. Home Language	6
II. First Additional Language	5
III. Mathematics	6
IV. Science and Technology	3.5
V. Social Sciences	3
VI. Life Skills	4
• Creative Arts	1.5
• Physical Education	1.5
• Religion Studies	1

1.4.3 Senior Phase

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

Subject	Time allocation per week (hours)
I. Home Language	5
II. First Additional Language	4
III. Mathematics	4.5
IV. Natural Sciences	3
V. Social Sciences	3
VI. Technology	2
VII. Economic Management Sciences	2
VIII. Life Orientation	2
IX. Arts and Culture	2

1.4.4 Grades 10-12

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

Subject	Time allocation per week (hours)
I. Home Language	4.5
II. First Additional Language	4.5
III. Mathematics	4.5
IV. Life Orientation	2
V. Three Electives	12 (3x4h)

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.

SECTION 2

INTRODUCTION TO TECHNOLOGY

2.1 Purpose

Technology education was introduced into the South African curriculum in recognition of the need to produce engineers, technicians and artisans needed in modern society, and the need to develop a technologically literate population for the modern world. The subject stimulates learners to be innovative and develops their creative and critical thinking skills. It teaches them to manage time and material resources effectively, and provides opportunities for collaborative learning and nurtures teamwork. These skills provide a solid foundation for many FET subjects, as well as for the world of work.

In this context Technology can be defined as:

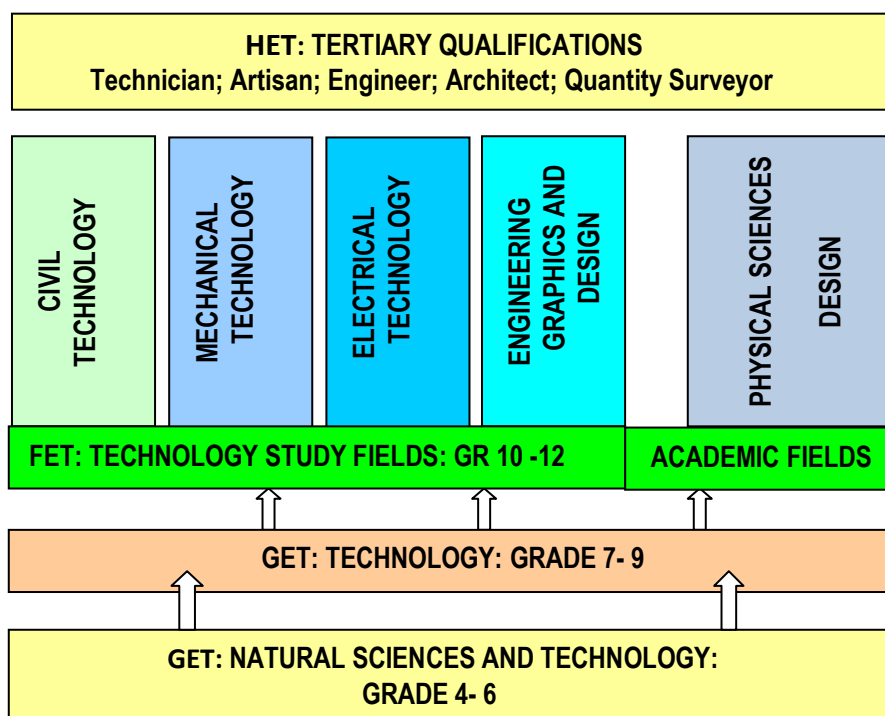
the use of knowledge, skills and resources to meet people's needs and wants by developing practical solutions to problems, taking social and environmental factors into consideration.

2.2 Aim

The Technology subject contributes towards learners' technological literacy by giving them opportunities to:

- Develop and apply specific design skills to solve technological problems.
- Understand the concepts and knowledge used in Technology Education and use them responsibly and purposefully.
- Appreciate the interaction between peoples' values and attitudes, technology, society and the environment.

The intention is to **introduce** learners to the **basics** needed in Civil Technology, Mechanical Technology, Electrical Technology and Engineering Graphics & Design. Together with this aspect, **evaluation** skills that will be fostered, and the introduction of the **design** and **production** of products will be useful in other FET subjects that use these skills – like Consumer Studies, and Design. It is expected that Technology Education should provide learners with some experience to **help** them with **some** career oriented **subject choices at the end of Grade 9**.



2.3 Unique features and scope

The Technology subject gives learners the opportunity to learn:

- by solving problems in creative ways
- while using authentic contexts that are rooted in real situations outside the classroom
- by combining thinking and doing in a way that links abstract concepts to concrete understanding
- to work collaboratively with others
- while doing practical projects using a variety of technological skills (investigating, designing, making, evaluating, and communicating) that suit different learning styles
- to evaluate existing products and processes, and to evaluate their own products
- to use and engage with knowledge in a purposeful way
- to deal with inclusivity, human rights, social and environmental issues in their tasks
- to use a variety of life skills in authentic contexts (such as decision making, critical and creative thinking, cooperation, problem solving and needs identification)
- while creating more positive attitudes, perceptions and aspirations towards technology-based careers

Key issues to teach:

1. problem solving using the design process
2. practical skills
3. knowledge and application of knowledge.

2.4 Topics and core content areas in Technology

- The table below indicates the main topics in the Technology curriculum.

1.	THE DESIGN PROCESS SKILLS: ○ investigation ○ design ○ make ○ evaluation ○ communication
2.	STRUCTURES
3.	PROCESSING OF MATERIALS
4.	MECHANICAL SYSTEMS AND CONTROL
5.	ELECTRICAL SYSTEMS AND CONTROL
6.	TECHNOLOGY, SOCIETY AND THE ENVIRONMENT
7.	IMPACT OF TECHNOLOGY
8.	BIAS IN TECHNOLOGY

- There are four core content areas in Technology in Grades 7 - 9. These are

▪ **STRUCTURES** ▪ **PROCESSING** ▪ **MECHANICAL** and ▪ **ELECTRICAL SYSTEMS & CONTROL**

These four content areas form the basis of the **four strands** which must be done each year in every grade. The recommended approach will be to introduce the required knowledge followed by **practical** work in which the knowledge is applied. In all cases, the teaching will be structured using the **Design Process** as the backbone for the methodology.

Some of these elements will be assessed formally each term.

As learning progresses, learners must be made aware of the interrelationship between technology, society and the environment. Wherever applicable, learners should be aware of different coexisting knowledge systems. They

should know how **indigenous cultures** have used specific materials and processes to satisfy needs, and be aware of indigenous intellectual property rights. Learners should be able to consider the **impact of technology**, both positively and negatively, on people's lives. Learners should be aware of **bias in technology** and be able to express opinions that explain how certain groups within society might be favoured or disadvantaged by products of technology.

<i>N.B. All electric circuits must be battery powered in the GET Band – Max 9V dc.</i>

2.5 The importance of design in Technology education

No product has ever been manufactured that did not undergo development through **design**. Technology education is an introduction to a range of careers that work in similar ways. All tend to use the **Design Process** as they develop solutions to problems, needs or wants. The country needs informed, critical consumers.

A key element to teach is the ability to **design**.

With many similar products on the market, design excellence is a key element in attracting consumers.

"Whether it is style on the outside or innovative technology on the inside, cutting-edge design is now more than ever vital in keeping a company or product competitive. Is it ergonomically sound? Will it stand up to repeated use or resist abuse? Is it designed to be fit-for-purpose? Will the consumer see value in it? Will it be safe to produce and use? Is it environmentally friendly? Will it impact negatively on certain groups?"

Ref: The Design

Encyclopaedia

Some careers that use design

- | | |
|--|---|
| ▪ a civil engineer designs a bridge | ▪ a dietician designs a diet for refugees with malnutrition |
| ▪ an architect designs a house | |
| ▪ a textile designer develops a textile for a specific purpose | ▪ a mechanical engineer designs a machine to lift a load |
| ▪ an electrician designs the electrical wiring for a home | ▪ a structural engineer designs the support system for the roof of a stadium. |

All these designers need to have:

- an **understanding** of the problem, need or opportunity
- **knowledge** of the Design Process
- **knowledge** of types and properties of suitable materials, and how to use them optimally
- the ability to **calculate** the quantities and costs of the materials needed
- **knowledge** of the conventions / building codes
- an ability to **sketch** initial ideas on paper
- the ability to **draw** working drawings in sufficient detail for the task
- the practical skills required to **create** a solution
- the ability to work **safely** using appropriate tools
- the ability to **present** the solution effectively to the client / customer.

2.6 Teaching methodology (*how tasks will be approached*).

N.B: As the 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 BUT the learners must show that they can **use the knowledge**, and not just memorise it.

The **Design Process** (Investigating, Designing, Making, Evaluating and Communicating - IDMEC) forms the *backbone* of the subject and should be used to structure the delivery of all the learning aims. Learners should be exposed to problems, needs or opportunities as a starting point. They should then engage in a systematic process that allows them to develop solutions that solve problems, rectify design issues and satisfy needs.

Investigating in this subject involves finding out about *contexts and needs*, investigating or evaluating *existing products* in relation to key design aspects and *performing practical tests* to develop understanding of particular aspects of the content areas or determining the fitness-for-purpose of products. While doing investigations, learners should be provided with opportunities to explore values and attitudes and develop informed opinions that can help them to make compromises and value judgements. Investigating can happen at any point in the Design Process. It should not be seen as something that must be completed before designing begins.

Designing, making and evaluating. These skills should not be seen as separate - they are inter-related.

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 learners progress they should be able to demonstrate **increasing accuracy and skill, better organisation** and **safer working practices**.

Criteria for teaching and assessing design features:

- originality and Aesthetics elements
- 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.

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

In Grade 9, Technology will be developed as an extension to the groundwork laid previously, and in preparation for the technical and engineering fields of the FET, as well as learners who may be inspired to become engineers.

The Grade Nine learner must be able to identify and explain a problem, need or opportunity from a given real life context.

Note on drawing:

In the GET band, drawing is separated into three possible fields:

- learners draw free-hand sketches as part of the DESIGN phase
- learners develop **working drawings** as part of the **making stage** using formal draughting techniques in line with conventions
- learners draw **artistic impressions** as part of the **communication stage** - using artistic techniques including perspective, texture rendering, shading, colours and shadows in order to **advertise** the product to potential users.

N.B.: Perspective drawing here is purely artistic and has no link to the method of linking the perspective to the working drawing, using construction lines.

2.7 Time allocation for Technology

The teaching time for Technology is 2 hours per week. As this subject involves practical work, sixty minutes of the 2 hours should be one continuous period for practical work, e.g. one double period comprising of 2 periods of 30 minutes. Schools using alternative period lengths or a cycle system, must ensure that all subjects get their correct time allocation.

2.8 Requirements for Technology

1. Each learner must have:
 - a textbook
 - a 72 page A4 workbook / exercise book
 - stationery including basic drawing instruments: pencil, eraser, ruler and set squares.
2. A designated teaching venue with a specialized Technology teacher.
3. Technology rooms must be secure, with doors that lock, and with burglar-proofing if possible. Enough cupboards should be available to store and lock away all resources.
4. It is **the responsibility of the school** to provide each learner with the minimum tools and material to meet the needs of the subject. (See Appendix B for possible tools and resources).

SECTION 3

Annual teaching plan

GRADE 7

TERM 1

It is compulsory to cover the given topics in the term indicated. The sequence of the topics within the term must be adhered to.			
Skills like investigating, drawing, designing, making and presenting should improve progressively from term to term.			
Week	Topic	Enabling Tasks	Content
Enabling Tasks – build the capability to complete the formal assessment tasks later in the term			
1 2 hrs	What is Technology? The Design Process Design considerations	Definition Scope: Who does Technology in the 'world of work?' Investigate: finding, using and acknowledging information. Design: design brief, specifications, constraints; initial idea sketches; choosing the best design; selecting materials. Make: drawing plans; develop the manufacturing sequence; make the item / model Evaluate: learners evaluate both their design stages and their final product. Communicate: learners present their solutions; learners compile all notes and drawings into a project report in their class-work books. Fit-for-purpose: Who is it for? What is it for? Will it do the job? Is it cost effective? Is it safe? Is it easy to use (ergonomics)? Does it look good (aesthetics)? Will it affect society? Will it affect the environment?	
2 2 hrs	Introduction to graphical communication	Purpose of graphics: develop ideas and communicate ideas. Conventions: outlines (thick/dark); construction lines (thin/feint); hidden detail (dashed) scale; dimensioning. Sketching: free-hand sketching. Working Drawings: 2-dimensional drawing of ONE face of an object using conventions (dark lines; feint lines; dashed lines; dimensions; scale).	
3 2 hrs	Graphic techniques	3-D oblique – front view with depth at 45° (use squared 'quadrant' paper); oblique projection used to assist with interpretation, and with drawing single VP perspective. 3-D artistic - single vanishing point perspective with colour, texture and shading.	
4 2 hrs	Simple mechanisms	Lesson: Levers - mechanical advantage - simple qualitative treatment – no calculations. 1 st Class levers: characteristics (fulcrum/pivot placed between effort & load). 1 st Class levers may give a mechanical advantage or not – depending on pivot position. Case study: 1 st Class levers with mechanical advantage: $MA > 1$; $MA = 1$; $MA < 1$	
5 2 hrs	Simple mechanisms (cont.)	Lesson: Levers 2 nd Class levers: characteristics (load placed between effort & fulcrum); examples. Learners demonstrate models of 2 nd Class levers which always give a mechanical advantage. 3 rd Class levers: characteristics (placed between effort & fulcrum). Learners demonstrate models of 3 rd Class levers which never give a mechanical advantage.	
6 2 hrs	Simple mechanisms (cont.)	Investigation: Levers and linkages Examine linked 1 st Class levers (e.g. pair of scissors, pair of pliers; hedge trimming shears). Examine linked 2 nd Class levers (e.g. office punch, bicycle brake calliper, nut crackers). Examine linked 3 rd Class levers (e.g. office stapler, pair of tweezers).	
Short practical assessment task: "miniPAT"		JAWS-OF-LIFE: Rescue System	[70%]

7 2 hrs	• Simple mechanisms (cont.)	Scenario: Impact of technology - emergency workers use “Jaws-of-Life” system to rescue trapped accident victims. Lesson: Using pneumatics and hydraulics to enhance human strength. Investigation: Force transfer between two equal syringes filled with 1) air and 2) water. Investigation: Force transfer between two unequal syringes filled with 1) air and 2) water.
8 2 hrs	• TASK	Design & make: Learners work in teams to develop a working model of a hydraulic-syringe powered, linked-lever rescue device using simple materials. Design brief, specifications and constraints: A 3-D drawing of the idea in oblique projection using dark and feint lines A sketch in single VP perspective enhanced using two of colour, texture or shading. A working drawing in 2-D showing one view with dimensions to scale.
9	• TASK (cont.)	Make: The working model. Communicate: Book mark.
10	• Summative Assessment	Test (Note: the test may be written before the MiniPAT) {30%}

Formal Assessment: Term 1: weighting: 10% of promotion mark		
Summative test: {30%} Total: 100%		
Formative: (0%) miniPAT: [70%]		

Annual teaching plan

GRADE 7

TERM 2

Week	Topic	Enabling Tasks	Content
1 2 hrs	Structures ▪ Definition ▪ Classification ▪ Types	Structures	Definition and purpose of structures to contain, protect, support, span. Classification of structures: natural and man-made. Types of structures: shell, frame, solid – learners complete a worksheet.
2 2 hrs	Task: Introduction - A cell-phone tower	Investigation: A cell-phone tower – a frame structure	Case study: examine existing towers strengthened by triangulation including pylons, windmills, mine headgear Evaluation: worksheet on the advantages & disadvantages of telephone systems; landline v mobile. Learners complete a table.
3 2 hrs	Building practical knowledge for the task	Action research: to strengthen materials	Practical activity 1 – Strengthen a structural material by <u>tubing</u>. Practical activity 2 – Strengthen a structural material by <u>folding</u>. Practical activity 3 – Strengthen a structural material by <u>triangulation</u>.
4 2 hrs	Further investigation – existing designs	Design issues: impact of technology	Case study: Study photographs of existing cellphone towers noting structural elements, reinforcing techniques, and design issues like visual pollution. Class discussion: how designers consider the needs of society in terms of technology while considering the impact on society and on the environment. Case study - existing designs 1: Examine the <u>features</u> of a school desk; write the <i>design brief</i> with <u>specifications</u> for a school desk. Case study - existing designs 2: Examine an existing product (FM Radio / Cell- phone), list its features and then write a design brief with specifications for that product.
Short Practical Assessment Task: "miniPAT" The cell-phone tower			[70%]

5 2 hrs	• Design Brief • Initial ideas	Writing the design brief for the task: Individual learners write the design brief with specifications for a new cell-phone tower. Sketching initial ideas: Individual learners use free-hand sketches to draw two different design ideas in 3-D for a cell-phone tower to be erected near the school. Draw one idea using oblique and the other using perspective. At least one of the design ideas must involve disguising the tower so that it blends in with the surroundings, avoiding visual pollution. Learners form groups of five to examine and discuss the various design ideas of the individuals in the group. They evaluate the sketches of each individual to determine advantages and disadvantages of each design. Individual learners now adapt their own design ideas in terms of the group evaluation making any improvements needed.
6 2 hrs	• Make • Planning	Making includes working drawings, choosing materials and tools, and building the model. Measuring and simple tool skills must be developed. Simple materials like straws, paper dowels or 'elephant grass' should be used. Sufficient strength and rigidity should be achieved by triangulation. Safe, cooperative working is a key skill and needed in the world of work. Each learner lists the resources to be used. Each learner draws a working drawing for the cell-phone tower showing one face in 2-D. Learners form teams and select the best plan from those drawn by each team member.
7 2 hrs	• Build • Evaluate	Building the model: Learners work in teams to develop the design they chose by consensus from the plans drawn by each group member. The team adapts a final plan from these. Teams build the model using safe working practices. Learners develop a team rubric to evaluate the models of other teams. They use their rubric to assess the models of 3 other teams <i>during the team's presentation.</i>
8 2 hrs	• Communicate	Presentation: Teams plan a joint strategy to present their model and plans. Teams present their design sketches, modifications, plans and models to the class. Each learner explains the role s/he played, sharing the role of spokesperson. They each enhance their presentation using posters giving an artist's impression of their completed cell-phone tower in position near the school drawn using single VP perspective.
9-10	Summative assessment: Midyear exams	

Formal Assessment: Term 2: Weighting: 10% of promotion mark

MiniPAT: [70%]

Summative Exam: {30%}

Total: 100%

In preparation for the school recycling and fund-raising activity in Week 2, learners must begin to collect data on waste materials generated both at school and at home from the first day of Term 3.			
Week	Topic	Enabling tasks	Content
1 2 hrs	• Magnetism	Investigation: Introductory lesson – what is magnetism? Action research: Different types of <u>permanent</u> magnets – bar & horseshoe. Learners find the shapes of magnetic fields using iron filings on paper above magnets. Experiment: Group work – learners find out which substances stick to a magnet. They tabulate their test results, trying wood, plastic, iron, paper, copper, old nickel coins, etc. They should conclude that <u>some</u> metals do stick to magnets but that <i>non-metals</i> do not.	
2 2 hrs	• Magnetic metals • Recycling scrap metals	Experiment: Which <i>metals</i> are attracted by a magnet, and which are not? Learners test metal samples made of iron, steel (an iron alloy), nickel – which will stick. Learners test metal samples made of copper, lead, aluminium brass – which will not stick. Each learner completes a table of the results. Note: <i>avoid iron coated-with-copper (like some paper clips) which will stick to magnets.</i> Case study: Recycling scrap metals – impact of and bias in Technology. Honest gleaners who collect scrap metal and deliver it to scrap metal dealers perform a valuable service to society. This good work is tainted by the criminal acts of thieves who steal copper telephone wire and steel man-hole covers. A recycling scheme for your school: Learners tabulate a record of the waste produced by the school e.g. empty cans, paper, plastic etc. Learners suggest a viable strategy to raise funds by recycling.	
3 2 hrs	• Introducing electricity • A simple electromagnet	Introductory lesson: Simple electric circuits. Demonstrate a simple electric circuit with an energy source (cell), switch, conductor and a light bulb or buzzer. Sketch the circuit showing how to use component symbols. ▪ Learners work in groups to make a simple circuit as demonstrated. ▪ Each learner draws the circuit using correct symbols for electrical components. Demonstration: Make a simple electromagnet made by winding insulated copper wire around an iron nail. When an electric current flows in the wire coil (solenoid) a magnetic field is created and this is amplified by the iron core. Switching the current off causes the magnetic field to die away.	
4 2 hrs	• More Simple Mechanisms	Introductory lesson: All complex machinery consists of combinations of simple mechanisms. Machines can be designed to give the user a “mechanical advantage.” Levers were looked at in Term 1. Introduce learners to cranks and pulleys. Lesson: The crank – an adaptation of a 2nd class lever. Lesson: The pulley – a type of wheel & axle. Revision: a) What is mechanical advantage? b) Strengthening frame structures	

Short Practical Assessment Task: "miniPAT"	Crane with electromagnet	[70%]
Background - problem scenario: A scrap-metal dealer sorts magnetic and non-magnetic metals into separate piles for recycling. The simplest way to do this is to use a crane with a magnet BUT it is difficult to remove the metals that do stick to permanent magnets. <i>It would be beneficial to have a magnet that can switch on and off.</i>		
NOTE 1: The model cranes should be made using simple materials (e.g. paper dowels or 'elephant' grass, etc). Sufficient strength and rigidity should be achieved by triangulation. Measuring and simple tool skills must be developed. Safe, cooperative working is a key skill and needed in the world of work.		
NOTE 2: The electromagnet will be strongest if a long insulated wire is used – wire over 100m long is very effective. The wire should be wound around a "relatively soft" iron core. Avoid using a steel bolt (it is far too hard). A fairly soft core can be made using a bundle of short lengths of wire. Nails are softer than bolts but are still fairly hard. Increasing the current by using more cells in a series battery has a small influence in the strength of the electromagnet.		

5 2 hrs	• Design	Learners must use their knowledge of structures and the drawing skills developed in earlier tasks, together with their new knowledge of magnetism, electric circuits and electromagnets as well as their new knowledge of cranks and pulleys to design and make a crane using an electromagnet to sort metals in a scrap-yard. Case study: Examine pictures of cranes in order to get ideas to be used in the learner's own designs. Write a design brief with specifications & constraints for a crane with electromagnet. Sketch two possible designs for a suitable crane using single VP perspective. Draw a circuit diagram for the electromagnet (with a light to show when it is on).
6 2 hrs	• Make	Revision: Revise the 3-D oblique drawing technique; line types; scale; dimensions. Drawing: Each learner uses the Oblique technique to draw an idea for the crane chosen from the two ideas sketched the previous week. The idea should be drawn on squared paper (quadrant) using pencil and ruler. Flow chart: Each learner works out a flow chart detailing the sequence of manufacture of the crane with its electromagnet.
7 2 hrs	• Make	Electromagnet: Using an electrochemical cell, a switch, a light bulb, a 'soft' iron core and a long length of insulated copper wire, the teams of learners make an electromagnet. Crane: Learners work safely in teams using simple materials to make a model crane with a crank and pulley system which will carry the electromagnet that will sort the ferrous metals (iron and steel) from the non-ferrous metals (copper, aluminium, lead, brass, etc).
8 2 hrs	• Evaluate	The learner's ability to evaluate a product or a process is developed further. Rubric: Each learner develops a rubric to evaluate the models of other teams. Assess: Each team uses the rubric to evaluate the models of other teams. Assess each learner's objectivity, fairness and the validity of their comments.
9 2 hrs	• Communicate	Planning: Teams plan a joint strategy to present their model and plans to the class. All team members must explain their ideas and roles they played when they present. Presentation: Each team presents the design sketches, working drawings and functioning model to the class. They demonstrate how strong their electromagnet is and show that it releases the load when switched off. Each learner explains the role s/he played and shares the role of spokesperson. They explain the principles involved with the magnetic sorting and how their electromagnet could be made stronger. They comment on the value of recycling and explain how sorting the metals into types improves their scrap value. They enhance their presentation using posters giving an artist's impression of their completed crane and electromagnet in use. Workbook: All notes, design briefs, sketches, flow charts, plans and posters.
Week 10 Summative assessment		Test (Note: the test may be written before the MiniPAT) [30%]

Formal assessment: Term 3:

Weighting: 10% of promotion mark

MiniPAT: [70%]

Summative test: {30%}

Total: 100%

Annual teaching plan		GRADE 7	Term 4
Week	Topic	Enabling tasks	Content
1 2 hrs	More simple mechanisms – ▪ Wedge ▪ Wheel & axle ▪ Gears – counter rotation – idler	Lesson: More simple mechanisms. All complex machinery consists of combinations of simple mechanisms. Well-designed machines give us a “ <i>mechanical advantage</i> .” Revision: Mechanical advantage. The wedge: e.g. inclined plane or ramp, door wedge, knife blade, etc. The wheel & axle: e.g. from bicycle to shopping trolley Gear: (wheel with wedges for teeth) Show how meshing of two spur gears causes counter-rotation Show how introducing an idler gear between two spur gears synchronises rotation of the driver and driven gears. Note: since a small idler will rotate more times than the larger gears, it should be made of harder material.	
2 2 hrs	More simple mechanisms – ▪ Gear ratios ▪ Cam ▪ Crank	Lesson: Gear ratios Show how different sized gears result in a change in the velocity ratio as well as an ‘opposite’ change in the force ratio – <i>if force increases, speed decreases, and vice versa</i> . Lesson: Mechanisms that change the direction of movement. The Cam: Show how a cam converts rotary motion into reciprocating motion. Compare an eccentric wheel and a snail cam. The Crank: An adaptation of a 2 nd class lever. Show how a crank converts rotary motion into reciprocating motion. Graphic skills: Learners draw an artist’s impression of one of each of the above mechanisms in their books using colour, shading and texture.	
3 2 hrs	Design & make	A short design & make activity intended to put the knowledge of mechanisms recently gained into practice. Learners must use safe working practices. Revision: The oblique technique for drawing 3-D with dimensions. Designing: Use the oblique technique to draw a design for each of the following: ▪ A child’s toy cardboard horse on wheels that can be pulled using a string. ▪ A child’s toy cardboard horse on wheels that can be pulled along using a string, but which moves up and down because the front wheels are cams. Making: Learners work in pairs to save on materials and tools and to develop collaborative and organisational skills. Learners do NOT have to get the same mark if their input differs. ▪ Using cardboard and glue make the cam-wheeled toy horse described above.	
4 2 hrs	Processing specialised clothing	Investigation: Learners investigate clothing worn by people in specialised occupations like the emergency services e.g. fire department, NSRI or dangerous professions e.g. racing drivers. Learners must investigate two of the following: Find out what textiles are used to make the clothing worn by fire-fighters. Find out what textiles are used to make the clothing worn by members of the NSRI. Find out what textiles are used to make the clothing worn by racing drivers.	
Short Practical Assessment Task: “miniPAT”		Processing	[70%]

5 2 hrs	Investigating	Investigation: Learners investigate materials and building techniques used by indigenous people for constructing housing in rural South Africa. Materials used in such construction is typically readily available, appropriate and environmentally friendly. Investigation: Learners investigate materials and building techniques used by migrant workers moving to the outskirts of cities in setting up informal settlements. Material used in such construction is typically difficult to obtain, inappropriate and environmentally unfriendly.
6 2 hrs	Task Emergency shelters and the impact of technology	Scenario: Tragic shack fires or natural disasters like floods or earthquakes or political strife may create the need for emergency shelters to be erected for the victims. Activity: Learners design and make an emergency shelter for disaster victims. The shelter must be sturdy, waterproof, easy to erect and able to house a family of six for a month. Investigate: Learners find out what chemicals can waterproof a textile like canvas. Design brief: Learners write an appropriate <i>design brief</i> with <i>specifications</i> for producing a textile suitable for use in making an emergency shelter. Design: Learners sketch design ideas for an emergency shelter which can be transported to and erected at a site where people have become homeless.
2 hrs	Make Emergency food and the impact of technology	Make: Learners work in teams to make a model (made of a water-proofed textile) of an emergency shelter suitable for housing refugees for period of at least a month. It should be easy to transport, easy to assemble, and easy to pack away after use. Processing food: Investigate the type of food that can be supplied to occupants of a refugee camp. Design Brief: Learners write a design brief giving specifications of the types and quantities of food needed for a population of 100 refugees. Design: List the ingredients of a meal that will be nutritious as well as tasty, and which can be prepared under conditions likely to be found in a refugee camp.
8 2 hrs	Make	Make: Write down the sequence of manufacture for the process of preparing one item from the meal described above. Make: Learners prepare the item selected above. Evaluate: Learners evaluate the item in terms of flavour, texture and nutritional value.

Formal Assessment: Term 4: Weighting: 10% of promotion mark

MiniPAT: [70%]

Total: $70 \times 1,43 = 100\%$

Week 9 -10	End-of-year examination	60%
------------	--------------------------------	------------

YEAR MARK : $100 + 100 + 100 + 100 = 400 \div 4 = 100$

Promotion mark: year mark (40%) + final exam mark (60%) = 100%

Grade 7,8 and 9

Formal Assessment: 4 mini-PATs + 4 term tests = 40% + year-end exam = 60% TOTAL: 100%				
Term 1	Term 2	Term 3	Term 4	Promotion Mark
Formative 0%	Formative 0%	Formative 0%	Formative 0%	Year Mark: 40% Final Exam: 60%
MiniPAT 70%	MiniPAT 70%	MiniPAT 70%	MiniPAT 70%	
TEST 30%	TEST 30%	TEST 30%	$70 \times 1,43 = 100\%$	
10	10	10	10	$40 + 60 = 100$
Total: 100%				

It is compulsory to cover the given topics in the term indicated. The sequence of the topics within the term must be adhered to.

Skills like investigating, drawing, designing, making and presenting should improve progressively from term to term.

Week	Topic	Enabling Tasks	Content
1 2 hrs	What is Technology? The Design Process Design considerations	Definition of Technology – revision. Scope: Technology in the man-made world – positive and negative impact on the world. Investigate: Finding, using and acknowledging information. Design: Design brief; specifications; constraints; initial idea sketches; selecting materials. Make: Drawing plans; develop the manufacturing sequence; make the item / model. Evaluate: Learners evaluate both their design stages and their final product. Communicate: Learners present their solutions; learners compile all notes and drawings into a project report in their class-work books. Fit-for purpose: Who is it for? What is it for? Will it do the job? Does it look good (aesthetics)? Is it easy to use (ergonomics)? Is it safe? Is it cost effective in terms of cost of 'real' materials, cost of labour? What should be the selling price? How will it impact society? How will it impact the environment?	
2 2 hrs	Graphical communication	Purpose of graphics: develop and communicate ideas. Conventions: Outlines (thick/dark); construction lines (thin/feint); hidden detail (dashed); centre lines (chain dash-dot); scaling up & scaling down; dimensioning (in mm). Working drawing techniques for planning: Single view flat 2-D drawing with dimensions, line types and scale. Isometric – using underlying isometric grid (Term 1) and instruments (Term 3).	
3 2 hrs	Graphical communication (cont)	Artistic: Double vanishing point perspective with colour, texture and shading. Sketching – using pencil, ruler and blank paper. Enhancing drawing to promote realism using colour, texture, shading and shadows.	
4 2 hrs	Frame structures	Lesson: Frame structures - definition of frame structures. Purpose of structural members (components) in a roof truss. Learners identify structural members & type of force (shear, torsion, tension, compression) acting on them in given frame structures. Case study: Electrical Pylons – use pictures of a range of pylon designs noting: ▪ the variety of designs that solve the same problem effectively ▪ the use of internal cross-bracing and triangulation to provide strength. Worksheet: Structural members under tension / compression.	
5 2 hrs	Structural members	Lesson: Structures that span over space. Beams: steel I-beams (girders), concrete lintels; beam & column bridge. Arches: arches in buildings, bridges, dam walls. Trusses: wooden roof trusses, steel roof trusses. Cantilevers: simple cantilever, inverted truss cantilever, cable-stayed cantilever.	
6 2 hrs	Mechanisms	Revision: levers & linkages Lesson: rack & pinion gear system Worksheet: Evaluating gear systems.	Revision: gears giving a mechanical advantage Lesson: worm gears
Short Practical Assessment Task: "miniPAT" School sports centre / multipurpose centre or stadium [70%]			

7 2 hrs	1. TASK 1	Learners work in teams to design & make a structure utilising required structural components and mechanisms. Evaluate: learners examine information on several complex structures and list advantages and disadvantages in the designs. Design: initial idea sketches. Design: design brief with specifications and constraints.
8 2 hrs	2. TASK (cont.)	Make: a 3-D isometric projection of the idea with dimensions and drawn to scale. Make: a working drawing in 2-D showing one view with dimensions and line types. Make: teams build their structure using safe working practices.
9 2 hrs	3. TASK (cont.)	Communicate: Teams present their plans and model. A sketch in double VP perspective enhanced using two of colour, texture or shading. Communicate: book mark.
10	4. Summative Assessment	Test [30%]

Formal assessment: Term 1: weighting: 10% of promotion mark

Formative: (0%) miniPAT: [70%] Summative Test: [30%] Total: 100%

Annual teaching plan

GRADE 8

TERM 2

Week	Topic	Enabling tasks	Content
It is compulsory to cover the given topics in the term indicated. The sequence of the topics within the term must be adhered to.			
Skills like investigating, drawing, designing, making and presenting should improve progressively from term to term.			
1 2 hrs	Processing Impact of technology	Many natural materials have been replaced in modern times by new or improved materials. Some new materials are environmentally friendly by being bio-degradable. Case study 1: Investigate the impact of plastic shopping bags on the environment. Report: Learners write a report evaluating the effectiveness of using thicker, biodegradable plastic shopping bags which shoppers must buy.	
2 2 hrs	Impact of technology Design and make	Case study 2: Technology with a positive impact on society. Investigate how waste paper and cardboard are recycled to produce new products for the packaging industry. Practical activity: Design packaging for a purpose. A product requires packaging. The nature of the product determines the design and properties of the packaging material.	
3 2 hrs	Design and make (cont.)	Practical activity (cont.): Making packaging for a purpose. Learners work safely to make and assemble the packaging product designed in Week 2.	
Short Practical Assessment Task: "miniPAT" Impact of technology [70%]			
4	Impact of technology Investigate solutions	Case study 3: Some technologies can have a <u>negative</u> impact. Investigate a technological product that can have a negative impact on society. discussion: Facilitate a class discussion on possible solutions that can counteract or compensate for the negative impact of the technology identified.	
5	Forces (knowledge)	Revision: Forces that act on materials – tension; compression; bending; torsion; shear. Lesson: Adapting materials to withstand forces.	
6	Design Make	Design: Learners adapt a material or design a product that will solve the problem or reduce the impact or negative effects of the technology identified. Design: Learners sketch free-hand sketches showing two possible solutions. Make: Learners draw their chosen solution in 3-D using isometric projection. Make: Learners make the model / prototype / product they have designed safely.	
7	Evaluate	Learners evaluate their solution in terms of its effectiveness in solving or reducing the negative impact of the technology identified. Their evaluation will be assessed in terms of its objectivity, fairness, accuracy and scope (depth).	
8	Communicate	Communicate: Teams present their plans, model and evaluation.	
9	Mid-year examination		
10	Mid-year examination		
Formal assessment: Term 2: weighting: 10% of promotion mark			
Formative: (0%) miniPAT: [70%] Summative mid-year examination: [30%] Total: 100%			

Annual teaching plan**GRADE 8****TERM 3**

It is compulsory to cover the given topics in the term indicated. The sequence of the topics within the term must be adhered to.

Skills like investigating, drawing, designing, making and presenting should improve progressively from term to term.

4 2 hrs	Design Systems diagrams	Sketches (2-D) showing gear systems that: - provide an output force four times greater than the input force ($M.A = 4:1$) - provide double the rotation rate on a driven axle at 90° to the driver axle. Lesson: Bicycle gear system - Analysis of the gears used on modern bicycles – terminology: master/slave or driver/driven; chain wheel; cogs. Lesson: Systems diagrams Analysing a mechanical system by breaking it into input-process-output. - Systems diagram for a gear system with a mechanical advantage of 4:1 Planning a mechanical system to produce a specific output - Systems diagram for a gear train with the driven gear rotating faster than the driver.
5 2 hrs	Impact of technology Indigenous technology Bias in technology	Learners working in teams investigate and report on ONE of the following: <i>(Distribute the investigations so that all are covered and reported in each class)</i> Investigation: The impact on the environment as a result of mining: - acid mine drainage. Investigation: The impact on the environment as a result of mining: - dust pollution from mine dumps on residential areas. Investigation: Iron age technology: indigenous mining of iron in South Africa before the modern era. Investigation: Bias in technology: gender bias in career choice / opportunities related to mining.
Short Practical Assessment Task: "miniPAT" SIMULATION – Tendering for Mine Head-gear [70%]		
CAPABILITY TASK: Mechanical Systems & Control South Africa is a country rich in mineral resources. We have huge reserves of coal, copper and iron ore. We are the main suppliers of platinum, manganese and chromium in the world. Although it is the source of our nation's wealth, mining is a dangerous, labour intensive activity that has negative impacts on the environment. The deeper our mines penetrate into the earth's crust (over 5 km), the more dangerous mining becomes since tunnelling through rock under massive pressures leads to "rock bursts" and cave-ins which frequently threaten the lives of miners.		
Scenario: <i>A commercially viable ore body containing platinum group metals has been found and measured on land belonging to a tribe in rural South Africa. Drill samples have proved that the reef lies 500m below the surface and a decision has been taken to sink a shaft to this depth to conduct bulk sampling on a small scale before deciding on a mining method best suited for the size and value of the resource.</i> Your mechanical engineering company decides to submit a tender for the construction of shaft head-gear suitable to transport miners to and from the work face, and for raising ore and waste in loads not exceeding 10 tons at a time.		

Week 2 hrs	Topic	Content
6 2 hrs	Mine head gear Design	Investigation: Lifting mechanisms (belt driven mine head-gear) in use at South African deep-level mines for raising people and ore. Sketching: Initial idea sketches to meet the requirements given in the scenario. Design brief with specifications and constraints.
7 2 hrs	Make	Simulation: Teams form mechanical engineering companies. They evaluate the sketches of individuals and select the best idea for the team tender bid. Drawings for the shaft head-gear: Each learner draws: a 3-D isometric drawing of the selected design giving dimensions and drawn to scale a 2-D working drawing showing one or more views with dimensions and lines. Budget: Teams prepare a realistic budget detailing expected costs of constructing a real mine shaft head-gear, detailing valid prices of materials and labour costs of the range of workers who would be involved in designing and building such a device.
8 2 hrs	Make (cont.)	Teams build their working scale model using safe working practices.
9 2 hrs	Communicate:	Teams present their tender proposal for the mine shaft head-gear (research, plans, flow chart, model and budget) to the “Tender Board.”
10	Summative assessment	Test [30%]

Formal assessment: Term 3: weighting: 10% of promotion mark

Formative: (0%) miniPAT: [70%] Summative Midyear Examination: {30%} Total: 100%

Annual teaching plan

GRADE 8

TERM 4

It is compulsory to cover the given topics in the term indicated. The sequence of the topics within the term must be adhered to.

Skills like investigating, drawing, designing, making and presenting should improve progressively from term to term.

Week	Topic	Enabling tasks	Content
1 2 hrs	Circuit components Simple circuits	Revision lesson: Simple circuit components; input devices (electrochemical cell; generator; solar panel), output devices (resistor; lamp; heater; buzzer; motor); control device (switches). Correct connections, short circuits. Electrical components and their accepted symbols. Lesson: Drawing electrical circuits using accepted symbols (as used in Gr12 Exam): Set up circuits using a range of components. Draw the circuits using symbols.	
2 2 hrs	Energy sources Impact / Bias Evaluation	Lesson: Energy for heating, lighting and cooking in rural and informal settlements. Energy from illegal connections; ethical issues; safety considerations. Class discussion: equitable sharing of resources – industry needs reliable power for job creation; schools need power for lighting and computing. Written report: Learners write a balanced report on these issues.	
3 2 hrs	Sources of direct current	Lesson: Electrochemical cells: Advantages and disadvantages of series and parallel batteries. Practical: Making your own batteries: fruit, vegetable and salt water batteries. Lesson: Photovoltaic cells - advantages and disadvantages.	
4 2 hrs	Generating electricity Impact of technology	Investigation: Generating electricity for the nation: Advantages & disadvantages thermal power stations (steam turbines – sources of heat: coal, gas, nuclear, sun) hydroelectric power stations (including pumped storage schemes) wind driven turbines	
5 2 hrs	Power distribution	Lesson: Distributing electric power across the country. Alternating current; step-up & step down transformers; the national grid.	
6 2 hrs	More simple circuits Ohm's Law (Qualitatively)	Practical: Learners draw circuit diagrams AND connect circuits showing the effect of circuits with resistors connected in series and parallel. Lesson: Introduce Ohm's Law (qualitatively) using one cell, then two cells, then three cells connected in series and noting the effect on the brightness of a lamp. They must conclude that more cells in series (<i>more voltage</i>) will cause the <i>current strength</i> to increase, if the <i>resistance</i> does not change.	
Short Practical Assessment Task: "miniPAT"		Logic Gates	[70%]

Scenario: EITHER - Crime is a problem facing every community in South Africa. Criminals invade homes especially where women, children or the elderly are often vulnerable and defenceless. Armed response companies can be summoned to the scene by alarms triggered by panic buttons placed strategically in the house. Learners must find out about AND & OR logic gates and select the appropriate logic for wiring a panic button; **OR** Stair Light or Passage Light – you want to switch on the light on entering the passage / stair and switch it off at the other end, and vice versa. Learners must find out about AND & OR logic gates and select the appropriate logic for wiring a pair of switches.

7	AND Logic OR Logic Truth tables	Investigation: AND logic gate and where it is used. Investigation: OR logic gate and where it is used. Lesson: Truth tables for AND & OR logic conditions.
8	Dual switch system	Design brief: Learners write a design brief giving specifications for a suitable panic button system or passage light or stair light. Circuit diagram: Draw the circuit diagram using correct symbol conventions. Make: Connect the components specified to form the circuit suitable for at least two panic buttons linked to a home alarm system. Communicate: Learners draw the truth table for the device. Communicate: Learners prepare an advertising poster for their device.
9 & 10	Year-end examination	

Formal assessment: Term 4:

Formative: (0%) **miniPAT:** [70%]

Total: 70 x 1,43 = 100%

YEAR MARK: 100 + 100 + 100 + 100 = 400 ÷ 4 = 100

Promotion mark: year mark (40%) + final exam mark (60%) = 100%

Term 1 + Term 2 + Term 3 + Term 4 = 10 + 10 + 10 + 10 = 40% plus Final Exam 60% = 100%

Annual teaching plan

GRADE 9

TERM 1: STRUCTURES

It is compulsory to cover the given topics in the term indicated. The sequence of the topics within the term must be adhered to.

Skills like investigating, drawing, designing, making and presenting should improve progressively from term to term.

Week	Topic	Enabling tasks	Content
1 2 hrs	Working drawings	1 st angle orthographic projection: 3-dimensional objects on flat paper. Concept of drawing three different views: front, top & side. Simple cubes. Line types: dark, faint, dashed, wavy, chain. Scale and dimensions.	
2 2 hrs	Working drawings (cont.)	More complex 3-D objects drawn in orthographic projection with instruments. Design problem: flight of stairs and wheelchair ramp. Design brief specifying the number of steps, height of stair risers, width & gradient of ramp. Sketch the stair and ramp in 3-D using isometric projection. Draw a plan for the stair and ramp using 1 st angle orthographic projection to an appropriate scale, using correct views, line types & dimensions according to convention.	
3 2 hrs	Properties of materials that affect their performance in structures	Revision: Strengthening of structures using tubing, folding and triangular webs. Lesson: Strength of materials under the action of forces – metal cross-sections: tension (pulling); compression (pushing); bending of beams (compression & tension) torsion – using internal cross-bracing to resist twisting. Lesson: Properties of various construction materials: mass; density; hardness; stiffness; flexibility, corrosion resistance and prevention of corrosion.	
N.B: These skills should be developed progressively with each task. Do not spend more than the time allocated for this introduction. By the end of the year the learners should have developed the required level of competence. Level required after Week 2 - learners should be able do the following at an elementary level: - Learners draw a plan for an object of a given size. They use the 1st angle orthographic technique using correct line types, drawn to scale with dimensions. - Learners design a solution to solve a given problem and draw a suitable plan using 1st angle orthographic. N.B. It is most important that the plan can work. If the solution will not solve the problem it must be penalised, no matter how neatly it is drawn.			
Short Practical Assessment Task: "miniPAT"		The Contractors	[70%]
Task1: SIMULATION: Structures (Gr9 learners must be able to identify a problem from a given context) This task deals with the design of a structure that will solve a problem facing a community living on the far side of a river from the city. The local authority places an advertisement inviting contractors to submit tenders for a solution. Learners form teams to act as 'Contracting Companies' which will compete for the contract to solve the problem.			
4 2 hrs	Tenders Investigation	Lesson: The tender process. Investigation: Provide the scenario so that learners can investigate the problem situation and various possible structures which could solve the problem(s) they identify. Analysis of existing products relevant to the identified problem in terms of fitness-for-purpose (including suitability of materials), safety for users, costs of materials and costs of construction. Realistic costs of real materials, labour, etc.	
5 2 hrs	Design	Sketching initial ideas – each learner generates two possible ideas. Evaluate and adapt – teams evaluate individual ideas and develop a final idea. Design brief – learners write a design brief with specifications for the final idea. Flow chart – teams discuss how to proceed, then each learner draws a flow chart.	
6 2 hrs	Make	Working drawings: each learner draws the plan (or an aspect of the plan) using 1st angle orthographic projection with suitable scale, correct line types and dimensions. Model of a viable solution: built neatly to scale, showing intelligent use of materials.	
7 2 hrs	Make Costing	Model building continued: Learners use safe working practices.	

		Budget: Costing of the “real life” solution, including correct materials and labour costs.
8 2 hrs	Evaluate Communicate	Evaluation: Teams collaborate to produce an evaluation instrument. Each learner uses the instrument to evaluate their team's solution and that of another team. Team presentations: Teams present their tender bid to the “Tender Board.” All team members must be responsible for aspects of the presentation. Tenders consist of sketches, plans, budget, model and artistic impressions.
9	Communicate	Team presentations: continued. Book Mark.
10	Summative assessment	Test [30%]

Formal assessment: Term 1: weighting: 10% of promotion mark		
MiniPAT: [70%]	Summative Test: [30%]	Total: 100%

It is compulsory to cover the given topics in the term indicated. The sequence of the topics within the term must be adhered to. Skills like investigating, drawing, designing, making and presenting should improve progressively from term to term.

Week	Topic	Enabling tasks	Content
1 2 hrs	Using pneumatics and hydraulics to increase human strength Hydraulic principles	Revision: Syringe mechanics using two equal sized syringes linked by a tube. Force transfer between the syringes filled with: a) Compressed air – pneumatic system; and b) Water – hydraulic system. Action research: Learners experiment with two <u>different sized</u> syringes linked by a tube and filled with hydraulic fluid (water). Learners experience force transfer with either force multiplication or force division (depending on which syringe is the driver / master Lesson: Gases (like air) are compressible. Liquids (like water, oils) are incompressible. Action research: Pascal's principle – pressure exerted on one part of a hydraulic system will be transferred <i>equally, without any loss, in all directions</i> to other parts of the system. Note that equal volumes of liquid are moved through the systems, and this results in different extensions where syringes (cylinders) are of different sizes, so less distance/more force ($M.A > 1$); and more distance/less force ($M.A < 1$).	
2 2 hrs	Hydraulics in use	Lesson: The hydraulic press (including simple calculations). Lesson: The hydraulic jack Investigation: Design considerations ~ fit-for-purpose: Evaluate the design of the hydraulic jack in terms of: Who is it for? What is it for? Will it do the job? What should it be made of? What should it cost? Is it cost-effective? Does it look good (aesthetics)? Is it safe/easy to use for the end user (ergonomics)? Draw a systems diagram which describes the way a hydraulic jack works.	
3 2 hrs	Pulley systems Mechanical controls	Action research: Practical investigations: - Use a single wheel fixed pulley to change the direction of pull – $M.A = 0$ - Use a single wheel moveable pulley to change the direction of pull – $M.A > 0$ - Use a pulley block system (block & tackle) to determine the relationship between load-bearing ropes on moveable pulley wheels and $M.A$ (force multiplication). Investigation: Learners find out about the following mechanical control systems: Ratchet and pawl - Disc brake - Bicycle brake - Cleat.	
4 2 hrs	Gear systems	Lesson: Lead learners as they find out about the interactions of the following: - Revise: Spur gears of equal size counter-rotating - Revise: Spur gears of unequal size counter-rotating – note velocity & force relationships - Revise: Spur gears using an idler to synchronise rotation - Bevel gears of equal size – axis of rotation 90° - Bevel gears of unequal size – axis of rotation 90° – note velocity and force relationships - Rack-and-pinion gear system as found on automatic gates and steering racks - Worm gear system for large reduction in speed and increase in force.	
5 2 hrs	Evaluating Designs Artistic drawing techniques	Evaluation: Learners examine various items using mechanisms found in the modern kitchen and/or home, workshop/garage. Items like can openers, egg beaters and ratchet spanners should be evaluated in terms of: Who is it for? What is it for? Will it do the job? What material is it made of? Is the material suitable? What should it cost? Does it look good? Is it safe and easy to use? They report on three items. Revision lesson: Single vanishing point perspective. Learners draw a 3-D wooden object using single VP perspective. They enhance the drawing showing the texture of the wood grain, colour and shadows. Learners use single VP perspective to draw an inside view of the classroom.	
Short Practical Assessment Task: "miniPAT"		Problem solving	[70%]

4	Electronic systems	Sensors - important input devices: LDR: Light Dependent Resistor - a component whose resistance decreases with light. [dark - high resistance; bright light - low resistance]. Thermistor: A component whose resistance varies with temperature. Two types are made: +t: resistance <i>increases</i> with increasing temperature. -t: resistance <i>decreases</i> with increasing temperature. Touch or Moisture Detector: a component that can be bridged using a 'wet' finger, thus completing the circuit, indicating the touch. Capacitors: A component which can store and then release electrical energy.
5	Practical work	Simple Electronic Circuits: Learners draw, AND work in groups to assemble these simple electronic circuits: LED, 470Ω resistor, switch, and 4,5V series battery LDR, buzzer, 3V series battery NPN transistor, buzzer or bell, thermistors, variable resistor, 1kΩ resistor, 6V series battery (or DC power supply) 6V series battery, LED, 470 Ω resistor, 1000 μF capacitor, switch.
Short Practical Assessment Task: "miniPAT" Innovation [70%]		
PRACTICAL TASK: Electronic Systems Setting the scene <i>Duration of this lesson is one 30 minute period.</i> Systems where electrical and electronic systems are combined. This may be integrated with other aspects like structures, etc. Learners will not be expected to design an electronic circuit. They will assemble and connect the components of a given circuit and will design a suitable application for that circuit. The electronic circuit may contain sensor devices and/or use transistor(s). Scenario: Describe a situation where a given electronic circuit can be used to meet a need. Learners are given the task of building a given electronic circuit and finding an appropriate use for this circuit.		
6	Investigate Design	Investigate the situation and the nature of the need so that an appropriate circuit can be chosen to solve the problem, need or want given in the scenario. A given circuit must be incorporated into the design of a device that will use the electronics to address the problem, need or want. The design brief Each learner writes his/her suggestion for the design with specifications & constraints. Sketches Each learner draws the circuit diagram. Each learner produces a sketch in 3D showing the device that will use the electronic circuit. Teams meet and examine the individual suggestions to decide on a final solution.
7	Make	Plans: working drawings The learners produce plans for their device / model / prototype using 1st angle orthographic projection. The plans should include a 3D "assembly" drawing in exploded view showing how the model fits together. Each team member draws a working drawing of the design OR an aspect of the design. Make: device /prototype / working model The model must showcase a viable solution to the problem. It should be to scale and neat, and show intelligent use of available materials.

8 2 hrs	• Communicate	Team presentations: Each team is given 5 minutes to present their solution in the form of sketches, artistic impressions of the solution, working drawings / plans, costing, and their model.
9 2 hrs		Each learner compiles a record of his/her own individual contribution to the task. is should be reflected in each learner's class workbook.
10	• Summative assessment	Test [30%]

Formal Assessment: Term 3: weighting: 10% of promotion mark

MiniPAT: [70%] Summative mid-year examination: [30%] Total: 100%

Annual teaching plan

GRADE 9

TERM 4: PROCESSING

It is compulsory to cover the given topics in the term indicated. The sequence of the topics within the term must be adhered to. Skills like investigating, drawing, designing, making and presenting should improve progressively from term to term.			
Week	Topic	Enabling tasks	Content
1 2 hrs	• Extending life-span	Preserving metals (two methods theoretically, one method practically) 1.1. Painting 1.2. Galvanising 1.3. Electroplating	
2 2 hrs	• Extending life-span	Preserving food (two methods theoretically, one method practically) 2.1. Drying & salting 2.2. Pickling 2.3. Freezing	
3 2 hrs	• Investigation	Types of plastics and their uses Properties of plastics	
4 2 hrs	• Recycling	Lesson: Reduce – reuse - recycle Investigation: Identification of plastic identifying-codes and sorting for recycling. Case study: Recycling plastics as a fund raiser for the school / community. Systems diagram: Draw a systems diagram describing a plastics recycling project.	
5 2 hrs	• Investigation	Case study: Remanufacturing waste plastic into pellets for re-use. Case study: Moulding recycled plastic pellets into products.	
Short Practical Assessment Task: "miniPAT"		Reduce – Reuse - Recycle	[70%]
PRACTICAL TASK: Working with Plastics Setting the scene <i>Duration of this lesson is one 30 minute period.</i>			
Scenario: Describe a situation where cutting, joining, bending AND/OR moulding plastics can be used to make a plastic product that will satisfy a need, want or opportunity.			

6 2 hrs	Investigation	Case study: Plastics used on modern motor cars. Case study: Plastics used around the home. Problem identification: Learners identify a need or want that can be satisfied by the making of a plastic item of their own design.
7 2 hrs	Design Make	Sketching: Learners sketch their plastic item using isometric projection on grid paper. Plan: Learners draw their plastic item using 1st angle orthographic projection. Skills development: Learners practise the skills needed to manufacture their plastic item – measure, mark out, cut, bend and join. Moulding is an optional extra.
8 2 hrs	Make Evaluate Communicate	Practical sessions: Working safely, learners measure, mark out, cut and bend the materials for their plastic item, and then assemble the product. Evaluation: Learners write a critical evaluation of the products produced practically in Weeks 1 & 2, and of their plastic item. Class-work book: Each learner compiles a record of his/her term's work including extending the life-span of metals and food, properties and uses of various plastics, the plastics recycling strategy, the case studies, and the sketches and plans for the plastic item.
9	Final exam	Summative year-end examination covering knowledge, drawing skills, design issues, and values covered during the Grade 9 year. Questions should be balanced across Bloom's Taxonomy BUT with special emphasis on application of knowledge in a problem-solving context, as this is the essence of this learning area. <i>N.B. Recall of knowledge without understanding is of little value in Technology.</i>
10	Final exam	

Formal Assessment: Term 4:	
MiniPAT: [70%]	Total: $70 \times 1,43 = 100\%$
Summative year-end examination: 60%	Weighting: 60% of promotion mark
Term 1 + Term 2 + Term 3 + Term 4 = $10 + 10 + 10 + 10 = 40\%$ plus Final Exam 60% = 100%	

Grade 7,8 and 9		Formal Assessment: (4 Tasks)							
Term 1		Term 2		Term 3		Term 4		Promotion Mark	
Formative	0%	Formative	0%	Formative	0%	Formative	0%	Year Mark: 40%	Final exam: 60%
MiniPAT	70%	MiniPAT	70%	MiniPAT	70%	MiniPAT	70%		
TEST	30%	TEST	30%	TEST	30%	70 x 1,43 = 100%			
10		10		10		10		40 + 60 = 100	
Total: 100%									

SECTION 4

ASSESSMENT IN TECHNOLOGY

4. WHAT IS ASSESSMENT ?

- Assessment measures individual learners' attainment of knowledge and skills in a subject.
The information obtained from this process should:
 - inform learners about their strengths, weaknesses and progress,
 - assist teachers, parents and other stakeholders in making decisions about the learning process and the progress of learners.
- Assessment should be both informal and formal. In both cases regular feedback should be provided to learners to enhance the learning experience.

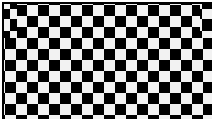
4.1 INFORMAL DAILY ASSESSMENT

- The informal daily assessment tasks are the planned teaching and learning activities that take place in the classroom or given as homework tasks. Learner progress should be monitored during learning activities. This informal daily monitoring of progress can be done through questions and answers, short activities/written work completed during the lesson, practical investigation activities and homework exercises such as doing design sketches, practising communication skills, evaluating or comparing products, etc. Informal daily assessment should not be seen as separate from the learning activities taking place in the classroom.
- Enabling tasks in technology are used to develop skills and knowledge that will be used during Mini-Practical Assessment Tasks (Mini-PATs) and written test / examination that will be assessed formally.
- Learners or teachers can mark the informal assessment activities. Self-assessment and peer assessment actively involves learners in informal assessment. It gives learners additional exposure to the learning materials and allows them to learn from and reflect on their own performance.
- The results of the informal daily assessment activities are not formally recorded unless the teacher wishes to do so. In such instances, a simple checklist or rating scale may be used to record this assessment. However, teachers may use the learners' performance in these assessment tasks to provide verbal or written feedback to learners, the school management team and parents. This is particularly important if barriers to learning or poor levels of participation are encountered.
- The results of the informal daily assessment activities are not taken into account for promotion.

4.2 FORMAL ASSESSMENT

- The teacher must plan and submit the annual formal programme of assessment to the school management team (SMT) before the start of the school year. This will be used to draw up a school assessment plan in each grade. The school assessment plan should be provided to learners and parents during the first week of the first term.
- Formal assessment provides teachers with a systematic way of evaluating how well learners are progressing in a grade and in a particular subject.
- Formal assessment for Technology will consist of mini-PATs and written tests or examinations.
- All formal assessment for Grades 7, 8 and 9 will be school based and set internally.
- The end-of-year promotion mark will comprise of **40% CASS** and **60% end-of-year examination**.

4.2.1 Formal Assessment Programme in Technology:

	INFORMAL DAILY ASSESSMENT 0%	FORMAL ASSESSMENT: TERM MARKS		
		Practical tasks & theory test / examination		TOTAL
		Mini-PATs	Term test / examination	Term mark
		70%	30%	100%
		70%	30%	100%
Term 1		70%	30%	100%
Term 2		70%	30%	100%
Term 3		70%	30%	100%
Term 4		70%	No test	70 x 1.43 = 100%

Promotion mark	CONTINUOUS ASSESSMENT (CASS)		FINAL EXAMINATION	Promotion
	Term1 + Term 2 + Term 3 + Term 4		Term 4	
	10 + 10 + 10 + 10	40%	60%	100%

This format means that the practical aspect of the subject forms a significant part of the term mark.

4.2.2 Mini-Practical Assessment Task

- As the name suggests, the mini-Practical Assessment Task is designed to give learners the opportunity to develop and demonstrate their levels of ability (i.e. capability) as they progress through the task's activities.
- These tasks are structured according to the design process:
Investigate – Design – Make – Evaluate – Communicate. This is not always a LINEAR process.
- Formal assessment in a mini-PAT does not need to cover all aspects of the design process each term.
The table below provides a guide for the Mini-PAT per term:

	TERM 1	TERM 2	TERM 3	TERM 4
GRADE 7	o Mini-PAT: Design + Make	o Mini-PAT: Investigate + Design + Make	o Mini-PAT Investigate + Design + Make + Evaluate + Communicate	o Mini-PAT: Design + Make
GRADE 8	o Mini-PAT: Communicate + Design + Make	o Mini-PAT: Investigate+ Design + Make	o Mini-PAT Investigate + Design + Make + Evaluate + Communicate	o Mini-PAT: Design + Make
GRADE 9	o Mini-PAT: Communicate + Design + Make	o Mini-PAT: Investigate + Design + Make	o Mini-PAT Investigate + Design + Make + Evaluate + Communicate	o Mini-PAT Design + Make

- A learner must present the full design process once as a mini-PAT in each grade.
- The most effective tool used to assess learner performance in a mini-PAT is the **analytical rubric**. *
- Resources for the mini-PATs are the responsibility of the school.
- Learners must complete the mini-PATs for formal assessment under teacher supervision.
- Teachers will assess the mini-PATs formally.

NOTE:

The Problem Solving Taxonomy of Plant et al, is more applicable as a guide to assessing a capability in Technology education. Unlike Bloom's taxonomy which does not take into account the previous experience of learners, in Plant's approach, the cognitive level is determined by previous experience. This fits well with the skills development in Technology where learners are expected to improve progressively through the year.

Problem solving Taxonomy (Plant et al, 1980)



5. Creativity level: Tasks require learners to **develop a solution** which was not previously known or to combine a few procedures in a new way.

4. Interpretation level: Learners are required to **simulate a real-life problem** and solve it. Learners reflect the result back to a real-world problem and implement its solution.

3. Strategic level: Problems which require learners to **select the most suitable solution** from a number of possible correct known options.

2. Diagnostic level: Tasks which require learners to **choose the correct routine** from a few known possibilities.

1. Routine level: Problems which require learners to **follow a familiar routine process**.

*** AN EXAMPLE OF AN ANALYTICAL RUBRIC TO ASSESS DESIGN CAPABILITY IN A Mini-PAT:**

The learner is able to:					
	LEVELS OF COMPETENCE				
	EXEMPLARY	COMPETENT	DEVELOPING , BUT NOT YET MASTERING	PROGRESSING	
	5	4	3	2	1
Generate and develop design ideas	Using drawings reflectively to generate new ideas	Progression of ideas across or within drawings	Design ideas are generated but not developed	Simple sketch showing object to be made	Drawing a picture not designing a product
Explore the possibilities of the problem / need	Combining novel solutions to produce innovative design	Using drawings to develop novel design solution/s	Recording possible creative solution/s to the task	Stereotypical response, showing little creative thought	Design possibilities are not addressed in the drawing
Address the constraints of the problem / need	Task constraints treated as part of iterative process	Task constraints considered as the design proceeds	Records way to address task & /or client needs and wants	Drawings shows some understanding of task constraints	Minimal understanding of task / user needs
Plan the look of the product	Ideas about finishing are developed within overall designing	Ideas about finishing are added to design whilst drawing	Overall decoration scheme considered	Little consideration of final appearance of product	Appearance of the product is not considered
Communicate design ideas	Clear enough for somebody else to make the product	Conveys sense of the object to be made e.g. working diagram	Conveys some sense of the object to be made: e.g. indicates materials	Simple unlabelled sketch (es) ; relying on shared meanings	Use of narrative or other drawing genre
Plan construction	Constructional issues considered on route to final design	Drawing demonstrates consideration of construction	Drawing indicates some consideration of construction	Minimal consideration of construction whilst drawing	Not planning to make the object drawn
Evaluate whilst drawing	Changes made a result of considering design drawings	Decisions made about product whilst drawing	Considered and rejected a range of ideas	Minimal evaluation at drawing phase	Yet to define the design task
Provide a basis for making	Using drawings as a resource during making	Clear development path through drawing into making	Object is one of the ideas drawn	Product relates to ideas recorded in the drawing	Making and object seen as separate new activity
Comments to improve the learners performance in design capability:					40

4.2.3 Tests

- A test for formal assessment should cover a substantial number of skills and content and should be set as follows:
Grade 7: 45 minutes Grade 8 & 9: 60 minutes
- The mark for tests is not prescribed but should be determined by the teacher taking into account the volume of the content covered and the time available.
- Testing in Technology will be limited to ONE test each term. This may take place either just before or just after the mini-PAT.

Term 1:	Term 2:	Term 3:	Term 4:
30% of term mark	30% of term mark	30% of term mark	Final Examination: 60% of final promotion mark

4.2.4 Examinations

- All examinations must include questions that integrate **knowledge** and **values** with **design process skills**.
- In Technology the final end of year exam comprises 60% of the learners promotion mark and should be set out as follows:

Grade	Time allocation	Mark weighting
Grade 7	60 minutes	70 marks
Grade 8	90 minutes	100 marks
Grade 9	120 minutes	100 marks

- Cognitive level weighting for end of year examination: Grade 7-9

KNOWLEDGE	UNDERSTANDING	APPLICATION	ANALYSE	SYNTHESISE	EVALUATE
Low order	Middle order		High order		
30%	40%		30%		

- Content weighting for end of year examination: Grade 7-9

Design process skills: (investigate, design, make, evaluate and communicate)	Knowledge: (structures, processing, mechanical and electrical / electronic systems and control)	Values and attitudes: (technology, society and the environment)
50%	30%	20%

4.2.5 Content to be assessed for the end-of-the-year examinations

The content assessed at the end of the year is based on the year's work covered for the specific grade. However, prior knowledge from a previous grade may be necessary to interpret and answer some of the questions in the higher grade.

4.2.6 Type of questions for written test

- The value of memorising by rote learning has little weight in a subject requiring **innovation**, **creativity** and **problem solving** skills. The ability to **think laterally** and to develop **original** and **appropriate solutions** is a key element in learning Technology.
- Learners should be able to **investigate** using a variety of sources, to demonstrate their ability to **draw** in a specific style, to **write** a design brief, to give specifications & constraints, to **select** appropriate materials for a

model, to **plan** the sequence of manufacture of a product, to **evaluate** a design objectively, to **analyse** a system using system diagrams and to **communicate** their solutions using a range of techniques.

- Questions that integrate knowledge, skills and value have more value in Technology than a mere recall of knowledge or facts.

4.2.7 The use of case studies

- Case studies are used to bring reality into the classroom.
- The intention should be to show learners that Technology is a subject that is close to the way the world works.
- Case studies can be used both to develop and to assess a technological skill (drawing for example), knowledge concepts, and values.

4.2.8 Moderation of assessment

- All Grade 7-9 tasks for formal assessment are internally set and moderated.
- The subject head for Technology or Head of Department at the school will manage this process.
- A teacher must keep all formal assessment tasks, assessment instruments and record sheets on file.

4.2.9 Recording

- Recording is a process in which the teacher documents the level of a learner's performance.
- Teachers record the actual raw score marks against the task using a record sheet. **
- Records of learner performance should also be used to verify the progress made by teachers and learners in the teaching and learning process. Records should be used to monitor learning and to plan ahead.

4.2.10 Reporting

- Reporting is a process of communicating learner performance to learners, parents, schools, districts and other stakeholders.
- In Grades R – 12, teachers report in percentages against the subject, using the following scale:

Codes and percentages for reporting in Grades R – 12

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

- Schools should provide feedback to parents on the programme of assessment using a formal report card once a quarter. The schedule and the report card should indicate the overall level of performance of a learner.

4.2.11 Barriers to learning and assessing

- Although there are many barriers to learning, teachers need to identify and build on strengths of learners in order to affirm their uniqueness. **All learners need to experience success.**
- Alternative strategies must be applied; more time, enlarged text, use of information communication technology, amanuensis or scribes in cases of learners with special educational needs.

- The use of alternative assessment relates to the change in the form of assessment used to accommodate all learners.
- Learners personal involvement with tasks often improves their attention span, patience, persistence and commitment.
- Designing and making real products that can be used, will give learners a sense of achievement and improve their self-esteem.
- The following strategies, depending on the physical barriers of the learners, could apply when supporting:
 - use the support of others to help pupils take part safely in practical work, for example, the assistance of adults or other learners to help them to hold or manipulate tools, or to carry out activities according to instructions is important that the learners should retain control of the making process and be the decision makers
 - learners can describe their design ideas for others to record or to translate into a drawing, whilst retaining control of the design idea and the modifications
 - work on shorter, more focused tasks, rather than longer, open tasks, will provide learners with incremental elements of success, and regular motivation and reward
 - use ICT applications, such as specialist software, to help sequencing and following instructions during practical work
 - use modelling, role play, tape recorders, video and photographs to communicate, develop and record their ideas
 - communicate using a range of methods avoiding over-reliance on the written word

** Sample recording sheet template;

SURNAME AND NAMES	Mini-Practical Assessment Task (Mini- PAT) Term 1, 2, 3													Term TEST EXAM	TERM MARK 100%	
	Formal Assessment	Act 1	Act 2	Act 3	Act 4	Act 5	Act 6	Act 7	Act 8	Act 9	Act 10	Book mark	Total 70%	Exam 30%		
	Description of Activity															
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
Teacher: Name: _____ Signature: _____ Date: _____																
Academic Head: Name: _____ Signature: _____ Date: _____																

SURNAME AND NAMES	Mini-Practical Assessment Task (Mini-PAT) Term 4														Year-end EXAM						PROMOTION MARK 100%
	Formal Assessment	Act 1	Act 2	Act 3	Act 4	Act 5	Act 6	Act 7	Act 8	Act 9	Act 10	Total 70%	X 1,43	Term 1: 10	Term 2: 10	Term 3: 10	Term 4: 10	TOTAL: 40	Exam: 60		
	Description of Activity																				
1																					
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					
11																					
12																					
13																					
14																					
15																					
16																					
17																					
18																					
19																					
20																					
Teacher: Name: _____ Signature: _____ Date: _____																					
Academic Head: Name: _____ Signature: _____ Date: _____																					

APPENDIX C: TOOLS FOR TECHNOLOGY

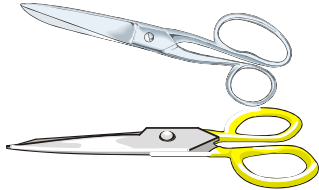
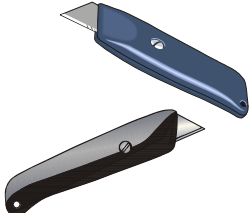
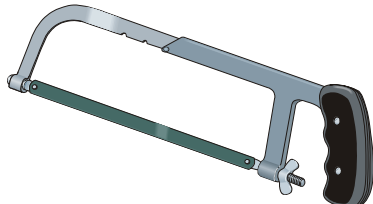
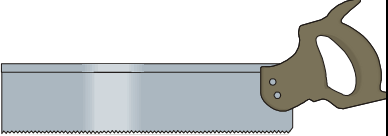
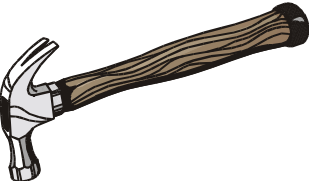
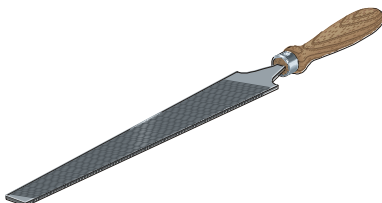
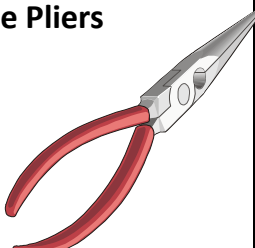
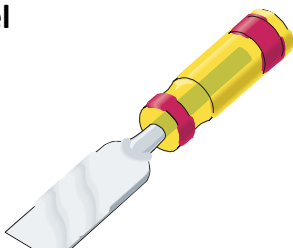
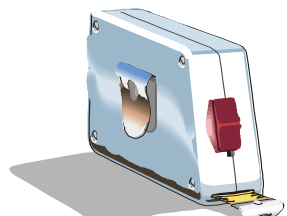
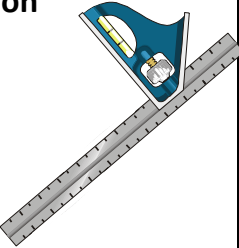
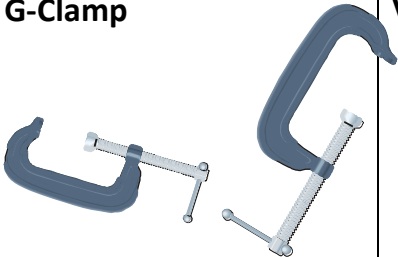
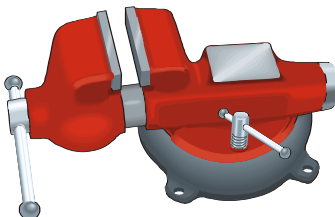
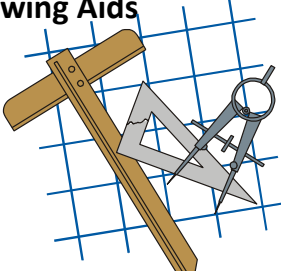
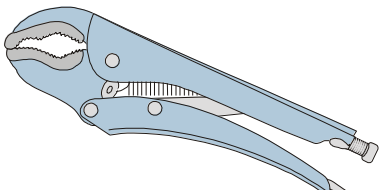
Sophisticated high-tech equipment is not needed to reach the aims of the Technology Subject.

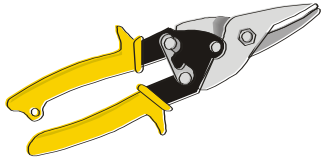
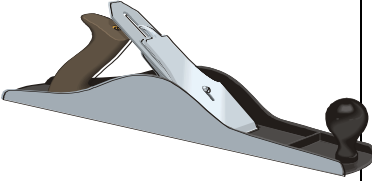
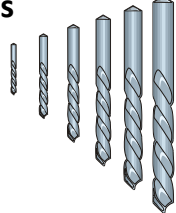
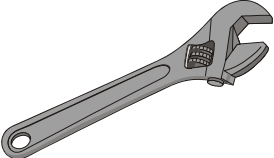
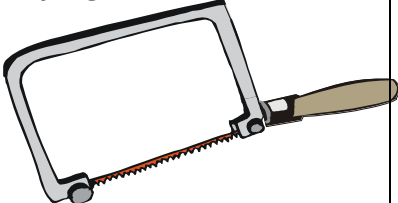
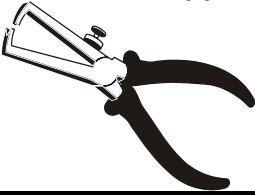
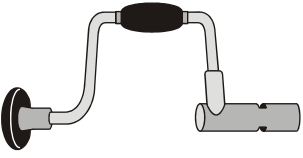
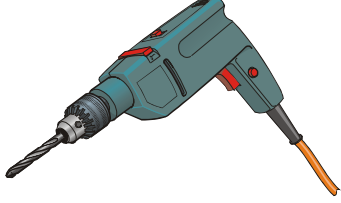
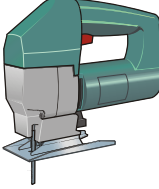
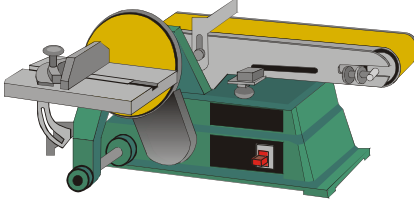
Simple tools and cheap materials are all that will be required for this syllabus.

Learners should be encouraged to manage with minimal supply levels as this develops **problem solving, lateral thinking and creativity**.

In GET, learners will require mainly scissors, craft knife, rulers, pliers, hammer, hand drill, junior hacksaw, coping saw, and simple materials like sticky tape, cardboard, foam plastic, and found materials.

Here is an illustrated list of the tools you may want to acquire for your Technology centre over a period of time.

Scissors 	Craft Knife 	Hacksaw 
Tenon Saw 	Claw Hammer 	File 
Long Nose Pliers 	Chisel 	Tape Measure 
Combination Square 	G-Clamp 	Vice 
Drawing Aids 	Screw Drivers 	Vice Grip 

Tin Snips [Metal Shears] 	Hand Plane 	Drill Bits 
Adjustable Wrench 	Staple Gun 	Safety Goggles 
Coping Saw 	Electric Glue Gun 	Hand Drill 
Wire Stripper 	Soldering Iron 	Hand Brace 
THE FOLLOWING POWER TOOLS ARE NOT REQUIRED, BUT ARE “NICE-TO-HAVES”		
Electric Drill 	Electric Jig Saw 	 Disc / Belt Sander

Electric Systems: Insulated electrical wire, torch cells, torch bulbs, crocodile clips, switches (push, SPST, SPDT, and DPDT), resistors, rheostat (variable resistors), voltmeter, and ammeter.

Electronic Systems: Diode, LEDs (various colours), light dependent resistor, thermistor, touch or moisture sensor, npn transistor, capacitor (polarised & unpolarised), buzzer/bell, 470 ohm resistor, solder, soldering iron, desoldering pump.

Precise descriptions will be given in the textbooks according to the tasks planned by different authors.

The following pages give details of tools and materials that could be found in very well-equipped Technology centres. Many of them will not be used by untrained teachers and should NOT be bought unless the task warrants it. Schools are encouraged to develop the subject to levels that have **high expectations** of their learners.

However, do not budget for items that cannot be justified by the curriculum.

TOOLS FOR DIFFERENT APPLICATIONS IN TECHNOLOGY

Solving problems in real life situations requires using a wide range of materials and many tools to process them.

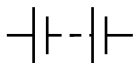
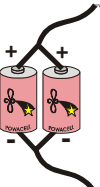
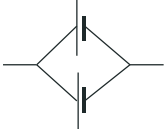
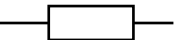
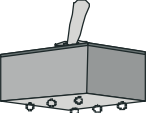
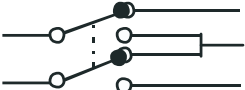
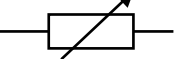
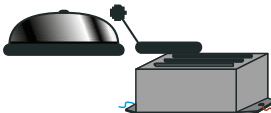
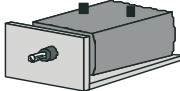
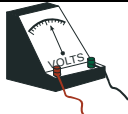
Here follows a list of possible applications and the tools needed to work on them.

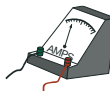
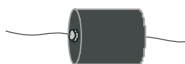
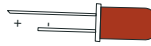
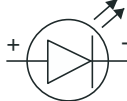
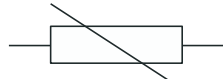
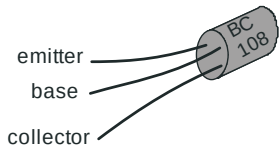
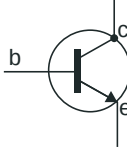
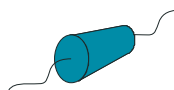
ADHESIVES

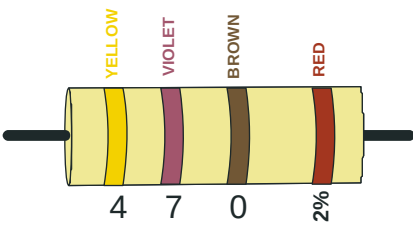
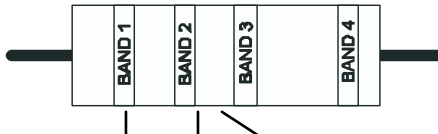
TYPE	PURPOSES	PROPERTIES	SETTING TIMES	BRAND NAMES	SOLVENTS
Clear cellulose adhesive	Wood, cork, leather, PVC	Waterproof, heat resistant, flammable	10-20 minutes	Bostik, Pattex, etc	Thinners, acetone
Contact Adhesives	Wood, hardboard, plastic, metal	Heat resistant and waterproof, flammable	5 minutes	Pattex, Alcolin, etc	Thinners
Cyanoacrylic "Superglue"	Plastic, glass, ceramics	Fairly strong but brittle, fails due to vibrations	Instant	Bostik, etc	Acetone
Epoxy resins	Wood, metal, glass, plastic	Very strong, heat resistant, waterproof	20 minutes to 24 hours	Pratley Putty etc	None once set
PVA	Wood, paper, card, hardboard	Strong but not heatproof nor waterproof	20 – 60 minutes	Alcolin, Pattex, Ponal, etc	Water - before fully dry
Homemade Flour paste	Paper, papier-mâché	Cheap, suitable for purpose	30 - 60 minutes	-	Water

WORKING WITH PAPER & CARD

Pencils:	H and HB grades are the most useful
Crayons:	Wax and pencil crayons – choose according to need
Felt-tipped pens:	Felt or nylon tips give clear permanent colours
Felt-tipped markers:	Large bullet or chisel pointed markers, with a limited colour range
Erasers:	Medium grade advised
Paints:	<i>Water based</i> – range from watercolours, poster paints, and acrylics <i>Enamel</i> – have a varnish base giving hard, glossy finish <i>Cellulose</i> – aerosol cans are available in most hardware stores <i>Primers and undercoats</i> – most bare surfaces need priming before applying the top coat <i>Varnishes</i> – these give a clear protective coating to paintwork Spirit-based varnishes dry quickly Polyurethane varnishes give a tougher finishes, but dry slowly
Brushes:	Brushes made from man-made fibres are cheaper and adequate for school purposes Small, pointed brushes are needed for fine detail; broader brushes are used for larger surfaces All brushes should be cleaned immediately after use using the same thinning medium as used for the paint
Stencils & transfers:	Used for lettering or applying pre-designed patterns
Craft knives:	A range of knives is available, from carpet knives to scalpels For safety, choose a size to suit the level of the learners, and be sure that the <u>blade is retractable for safety</u> reasons
Safety rulers:	These steel rules provide protection for fingers when cutting sheets of paper, cardboard or carpet using a craft knife
Rulers:	For <u>measurement</u> only – flat steel rulers and plastic rulers <u>may not be used to guide a craft knife when cutting</u>
Finding angles:	Use setsquares or a protractor to mark out angles
Drawing circles:	Use drawing compasses or use a circular shape as a stencil

Appendix D: Electrical Component Symbols: Grade 7, 8 & 9			
Name	Picture	Symbol	Use
Electrochemical cell			Input device: source of energy
Series battery			Input device: source of more energy
Parallel battery			Input device: source of energy for longer
Push switch			Control device: Used to temporarily close a circuit – like ringing a door bell
SPST switch (Single Pole Single Throw)			Control device: opens or closes a circuit
Lamp / light bulb			Output device: lights up when current heats it
Resistor			Process device that restricts the flow of an electric current
Electrical Component Symbols: Grade 8 & 9			
SPDT switch (Single Pole Double Throw)			Control device: diverts current down either one of two possible paths [an OR Logic Gate]
DPDT switch (Double Pole Double Throw)			Control device: diverts current down either one of two possible paths [an OR Logic Gate]
Variable resistor (rheostat)	Stove plate switch: High-Low Light dimmer switch Volume knob on FM Radio Heat setting on a steam iron		Adjustable process device: to restrict the electric current e.g. stove switch
Bell and buzzer			Output device: vibrates to give off sound when current passes through it – useful as an alarm.
Motor			Output device: motor turns converting electric energy into kinetic energy.
Voltmeter (Connect in PARALLEL)			Output device: meter responds to potential difference

Ammeter (Connect in <i>SERIES</i>)			Output device: meter responds to current
Electronic Component Symbols: Grade 9			
Name	Picture	Symbol	Use
Diode			Control device: allows current to flow in one direction only
LED Light Emitting Diode			Control device: allows current to flow in one direction only, and emits light
LDR Light Dependent Resistor			Sensor: Detects light Resistance decreases in bright light
Thermistor +t OR -t			Sensor: detects heat +t: hotter = more resistance -t: hotter = less resistance
Touch or Moisture detector			Sensor: detects moisture
Transistor npn			Control device: can act as a switch can act as an amplifier
Capacitor <i>Polarised</i>			Control device: can store and release energy must be connected + to +
Capacitor <i>Unpolarised</i>			Control device: Can store and release energy

RESISTOR COLOUR CODES																																																																																																																										
																																																																																																																										
The first three bands give the value of the resistor in ohms [Ω]. i.e. 470 Ω	<table><tr><th>COLOUR</th><th>1</th><th>2</th><th colspan="8">ZEROS</th></tr><tr><td>BLACK</td><td>0</td><td>0</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>BROWN</td><td>1</td><td>1</td><td>0</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>RED</td><td>2</td><td>2</td><td>0</td><td>0</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>ORANGE</td><td>3</td><td>3</td><td>0</td><td>0</td><td>0</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>YELLOW</td><td>4</td><td>4</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td><td></td><td></td><td></td></tr><tr><td>GREEN</td><td>5</td><td>5</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td><td></td><td></td></tr><tr><td>BLUE</td><td>6</td><td>6</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td><td></td></tr><tr><td>VIOLET</td><td>7</td><td>7</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td></tr><tr><td>GREY</td><td>8</td><td>8</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>WHITE</td><td>9</td><td>9</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table>	COLOUR	1	2	ZEROS								BLACK	0	0									BROWN	1	1	0								RED	2	2	0	0							ORANGE	3	3	0	0	0						YELLOW	4	4	0	0	0	0					GREEN	5	5	0	0	0	0	0				BLUE	6	6	0	0	0	0	0	0			VIOLET	7	7	0	0	0	0	0	0	0		GREY	8	8	0	0	0	0	0	0	0	0	WHITE	9	9	0	0	0	0	0	0	0	0
COLOUR	1	2	ZEROS																																																																																																																							
BLACK	0	0																																																																																																																								
BROWN	1	1	0																																																																																																																							
RED	2	2	0	0																																																																																																																						
ORANGE	3	3	0	0	0																																																																																																																					
YELLOW	4	4	0	0	0	0																																																																																																																				
GREEN	5	5	0	0	0	0	0																																																																																																																			
BLUE	6	6	0	0	0	0	0	0																																																																																																																		
VIOLET	7	7	0	0	0	0	0	0	0																																																																																																																	
GREY	8	8	0	0	0	0	0	0	0	0																																																																																																																
WHITE	9	9	0	0	0	0	0	0	0	0																																																																																																																
The fourth band is an accuracy rating % Most expensive & most accurate = RED Medium expensive & accurate = GOLD Least expensive & accurate = SILVER																																																																																																																										
RED – the resistor is within 2% of the coded accuracy value GOLD – the resistor is within 5% SILVER – the resistor is within 10%																																																																																																																										

WORKING with METAL

Metalwork is likely to be limited to small items – so there will be no need of bending machines and guillotines.

Learners are likely to work with wire, small metal rods for axles, flat bar, round bar, square bar, and lightweight metal sections, like angle iron.

Metals used will include iron, tin, copper and aluminium.

Cutting:	Junior hacksaw – preferably the type with vertical handle Hacksaw Metal snips / shears Side cutters – 160mm
Holding:	Engineer's vice – 100mm jaws, fixed to bench Vice grips – 280mm G-clamps – 100mm and 250mm jaws suit most jobs Combination pliers – 160mm Needle nose pliers – 160mm: for wirework
Marking:	Scriber Compasses / dividers
Guiding:	Try square – preferably with 45° mitre Combination square – measures 90°, 45° and depth Sliding "T" bevel – can be set at any angle
Drilling:	Hand drill [wheel brace] – for drilling holes up to 4mm in diameter Power drill – 350 to 500W will be adequate – holes from 1mm to 12mm diameter Twist drills – set 1mm to 12mm - use only HSS grade for metals
Joining:	Metals can be joined in a variety of ways: Shifting spanner – 250mm Bolting – a range of machine screws are available in brass or iron <i>Suitable sizes depend on purpose: 15mm to 40mm are most common</i> Riveting – using pop riveter and pop rivets, or hammered rivets Glueing – modern epoxy resins can bond metals very effectively Soldering – either using electric soldering iron or a gas flame <i>Soldering iron stands; desoldering pump</i>

WORKING WITH WOOD

Holding:	Carpenter's vice Bench hook G-clamps – 100mm and 250mm jaws suit most jobs Sash clamps – 500mm and 1200mm
Marking:	Carpenters pencil Scriber Compasses / dividers
Guiding:	Try square – preferably with 45° mitre Combination square – measures 90°, 45° and depth Sliding "T" bevel – can be set at any angle Mitre box – a guide for the tenon saw when cutting 45° and 30° mitres Spirit level
Measuring:	Steel tape – 3m retractable Steel rule – 300mm or 500mm
Cutting:	Tenon saw – the type with a ridged back is indispensable for many tasks Fretsaw – cuts curves and irregular shapes in thin wood – need spare blades Coping saw – similar to a fretsaw, but can be used to cut thicker wood Chisel set: range - 6mm, 10mm, 15mm to 20mm

Smoothing:	Smoothing plane – steel with adjustable blade, about 44mm wide Surform – easy-to-use tool with fixed-blade plane made by Stanley Tools Wood rasp – 250mm half-round: For rough shaping – flat and concave curves Flat file – 150mm fine cut – useful for model making Glasspaper – coarse to fine grades
Drilling:	Bradawl – for starting small screws and marking pilot holes before drilling Hand drill [wheel brace] – for drilling holes up to 6mm diameter Brace & bits – cut larger holes than the wheel brace 6mm to 30mm Twist drills – set 1mm to 12mm - note wood drills are not suitable for metals Countersink – to allow screw heads to lie flush with the surface
Screwing:	Screw drivers – flat 3mm, flat 5mm, star or cross head Wood screws – steel and brass – sizes according to needs – 15mm to 50mm Chipboard screws – steel – 15mm to 40mm
Nailing:	Claw hammer [350g] - claw is for pulling out nails Ball-peen hammer [300g] Cross-peen hammer [200g] – useful light-weight hammer Pin punch – for sinking panel pinheads below the surface Panel pins – sizes: 12mm, 19mm Nails – sizes: 12mm, 19mm, 25mm, 40mm

WORKING WITH ACRYLICS and OTHER PLASTICS

Acrylic plastics [e.g. Perspex] form a versatile group of materials for making plastic items. It can easily be clear or coloured and can be sawn, drilled and filed into shapes. It is supplied in transparent or opaque sheets, rods or tubes in a wide variety of colours.

Oven gloves:	For handling Perspex heated for bending
Cutting & shaping:	Craft knife, coping saw, fret saw, hacksaw Files [<i>flat, half round, needle</i>]
Marking:	Ruler, scribe, set squares, protractor, stencils, compass
Drilling:	Hand drill, set of twist drills
Bending:	Requires temperatures from 150°-180° Celsius
Holding:	G-clamps, bench vice, masking tape, double-sided tape
Joining:	Acrylic cement [glue], silver or copper wire [for riveting]
Finishing:	Wet-or-dry abrasive paper in a range of grades: – 240 coarse, 320 medium, 600 fine; and metal polish [e.g. Brasso].

CAUTION: All acrylic glues and resins are highly inflammable and should be kept away from naked flames. The fumes can be irritating and well-ventilated space should be used. Avoid skin contact by using rubber gloves. Wash with soap and water after accidental contact.

Electrically powered tools:

Electric drill:	450 to 600W with percussion
Jig saw:	Must have orbital action option and ability to plunge through undrilled surface
Belt sander:	80mm – avoid industrial strength equipment needing high skill and strength
Orbital sander:	1/3-sheet machines are adequate
Soldering irons:	Low power for electronics
Scroll saw:	Table model – used for wood and acrylics [more useful & safer than band saw]
Disc/belt sander:	Table model – 80mm wide belt, 150mm disc
Bench grinder:	Table model - one grinding wheel, one buffing wheel for acrylic work
Hot plate:	Two plate model
Line bender:	For bending acrylic plastics (<i>very simple candle-heated models exist</i>)
Vacuum former:	For vacuum-forming using ABS plastic sheets

APPENDIX D: Technology Subject Glossary.

This is an alphabetical list of key terms used in the Technology subject

Aesthetics

Characteristics of a product or system that makes it look beautiful and attractive.

Artefact

A manufactured object.

Anthropometrics

Measurements of people's shapes and sizes. Such measurements are usually taken when products are designed for human use e.g. furniture, eating utensils, hairdryers, sporting equipment cars, clothing, etc

Biases

People's preconceived ideas or prejudices about some things or people before they actually meet or deal with them. These are normally in areas of human rights and inclusivity such as gender, race, ethics, religion, etc. For example most cameras are biased towards right handed people, very few women enter the mechanical engineering industry in South Africa, etc.

Biophysical environment

The land, air, water around us, it is also the space in which we find ourselves.

Compression

A squeezing force.

Constraints

Aspects that limit conditions within which the work or solution must be developed e.g. time, materials, tools, human resource, cost, etc.

Control

The means by which systems are regulated, i.e. an adjustment of the process, which makes the actual result conform more closely to the desired result.

Conventions

Ways of showing information on designs or working drawings that are understood and recognized to have specific meaning.

Criteria

Statements of a particular standard or requirement that a solution must satisfy.

Data

Raw facts and figures (statistics, rainfall figures, temperature readings, etc). Data may be processed into information.

Design (noun)

The plan, sketch, model, drawing, etc. that outlines or shows the intention of the proposed solution.

Design brief

A short and clear statement that gives the general outline of the problem to be solved as well as the purpose of the proposed solutions.

Design process

It is a creative and interactive approach used to develop solutions to identified problems or human needs. This is one of the technological processes. Its associated skills are investigation, design (development of initial ideas), make, evaluation and communication. The Design Process can be explained as follows:

- **Investigate**

Investigating a situation to gain information is an important starting point for Technology. Research or finding of information mainly takes place here. Learners gather data and information, grasp concepts and gain insight, find out about new techniques, etc. Some skills needed for investigating are information accessing and processing skills, recording, identifying, predicting, comparing, observing, classifying, interpreting, collating, etc.

Design (verb)

Once a problem is fully understood, the design brief needs to be written. Possible solutions should then be generated. These ideas may be drawn on paper. The first idea may not necessarily be the best; so several different solutions are desirable. This part of the design process requires awareness and the knowledge and skills associated with graphics, such as the use of colour, rendering techniques, 2D and 3D drawings, etc. These in essence include abilities in planning, sketching, drawing, calculating, modelling, and managing resources. Once possible solutions are available, a decision must be made. The chosen solution will be the one that best satisfies the specifications. It is expected that learners justify choices made. At this point final drawings/sketches (working drawings) of the chosen solution should be prepared. They should contain all the details needed for making the product or system. These include instructions, dimensions, annotated notes, etc. Testing, simulating or modelling the solutions before final manufacture is done here.

2D – two-dimensional – a flat drawing, in which only two principle dimensions (measurements) are visible (e.g. length and height,).

3D- three-dimensional – a pictorial drawing. A drawing in which the three principle dimensions are visible, also the three principle faces are visible in the one drawing.

- **Make (verb)**

This aspect provides opportunities for learners to use tools, equipment and materials to develop a solution to the identified problem, need or opportunity. It involves building, testing and modifying the product or system to satisfy the specifications of the solution (design specification). Learners will cut, join, shape, finish, form, combine, assemble, measure, mark, separate, mix, etc. should be according to the design although modifications are also desirable. Making must always be undertaken in a safe and healthy atmosphere and manner.

- **Evaluate**

Learners need to evaluate their actions, decisions and results through the technological processes. Learners need to evaluate the solutions and the process followed to arrive at the solutions. They should be able to suggest changes or improvements where necessary. Some evaluation should be done against criteria (e.g. constraints) that may be given or self-generated. This stage requires the use of probing questions, fair test, analysis, etc.

- **Communicate**

In this aspect the assessment evidence of the processes follow any given project, i.e. the ability to analyse, investigate, plan, design, draw, evaluate and communicate. This could be done in various modes like oral, written, graphic or electronic presentation. A record of the processes from conception to realization of the solution (i.e. investigating to communicating solutions) should be kept in the form of a project portfolio.

Ergonomics

Features of a product or system that makes it user-friendly.

Findings

Things that have been discovered after a process of investigation or research.

Forming

Changing a material's shape without cutting it.

Input

The command/information entered into a system.

Information

Data that has been processed (recorded, classified, calculated, stored, etc). Knowledge is gained when different kinds of information are compared and conclusions are drawn.

Isometric

A 3D drawing where the lines of sight are set at 30 degrees.

Machine

A device made up of a combination of simple mechanisms linked so as to form a system for the purpose of doing work.

Materials

Physical substances used in technology, e.g. wood, textiles, fabric, plastic, food, etc.

Mechanical advantage

A concept that describes how much easier mechanisms or machines can make a particular task. The amount of work done is the same, and the amount of energy expended is the same, but the effort used (force) is less because it is applied over a greater distance.

Mechanism

Parts that can turn one kind of force into another and give mechanical advantage or a distance advantage.

Mechanisms can be combined to form a machine. The basic mechanisms are the lever and the wedge / inclined plane / screw. Cams/cranks and pulleys/gears are adaptations of the wheel & axle – which is itself a special case of the first class lever.

Mode

A way or manner in which a thing is done.

Modelling

The testing of a solution, (product or system). This could include using small replicas (scale models), and intangible representations of the solution (mathematical models, computer models, etc).

Need

A necessity for basic function e.g. food is a need.

Oblique

A 3D drawing where the lines of sight are set at 45 degrees.

Opportunity

The chance to do something about a need or a want.

Orthographic

A type of 2D drawing. It usually shows three separate views of the same object (e.g. front, top and left views).

Output

The actual result obtained from a system.

Perspective

A 3D drawing in which the lines of sight converge on the horizon.

Product

The physical / tangible artefact that results from the process (model, poster, chart, etc).

Portfolio

A systematic and organised collection of a learner's work. It includes findings, successful and unsuccessful ideas, notes on the process that was followed in developing solutions, data, pictures, drawings, etc.

Preserving

A process that prolongs the natural life of a product.

Process

The part of a system that combines resources to produce an output that is in response to input.

Problem

Something that leads to a need or want and that can give rise to an opportunity.

Pulley

A wheel with a groove on its circumference. It is used to transmit movement and is used with a belt.

Recycle

To reuse all or part of a substance, including breaking it down to raw material status.

Recyclable

A material that can be recycled.

Safety

The way that a person works with tools, materials and equipment that does not harm themselves or others physically.

Science

The study and description of natural phenomena.

Shaping

A process used to change the shape or contour of materials – shaping always involves the removal or addition of material.

Specification

An organized, detailed description of the requirements/criteria that the solution or product must meet, e.g. safety, size, material, function, human rights, environment, etc.

Structure

Something that has been built, made or been put together in a particular way.

System

Something that is made up of interlinked parts that function together as a whole to accomplish a goal. For example a mechanical system has a combination of mechanisms that make it function as a whole; an electrical system has interrelated electrical parts that work together to make the system do what it was designed to do.

Technological capability

The ability to use a combination of skills, knowledge, resources in a variety of contexts, to solve a technological problem. Capability leads to technological literacy.

Technological solution

A plan that arises by using a systematic problem solving process (ideas, flowcharts, models, etc).

Technological literacy

The ability to use, understands, manage, and assess technology.

Technological processes –

Creative human activities of developing technological solutions in order to satisfy human needs and wants. Technological processes include design, manufacturing, repair, restoration, etc.

Tension

A force that stretches an object or material, a pulling force.

Want

Something that people would like but do not actually need (a convenience).