Specialist Technical School Programmes
Syllabus Modules
Vocational Programmes

South Sudan

Contents

Technical and Vocational Education and Training (TVET)

The future wealth of a country relies on the quality of vocational education that it offers. For the learner, vocational education is the route to employment and to an income. For the nation, vocational education is the route to national prosperity.

There has been a tendency in South Sudan to see vocational education as a second rate option. This misconception has to be challenged. Every nation needs its very best young people to take a vocational route and to supply the qualified people the nation needs to build the economy and build future prosperity. All economies in the world need more people with vocational education than with an academic education.

UNESCO defines TVET as:

"the acquisition of practical skills, attitudes, understanding and knowledge relating to occupation in various sectors of economic life"

TVET programmes differ from academic pogrammes because they lead to a vocational qualification and are:

- Focused on a particular employment sector
- Practical and work-related
- Flexible in their response to developing sector practices
- Endorsed by employers

This makes them particularly valuable to the leaner.

The provision of TVET in South Sudan

In South Sudan, TVET is organised by a range of state and private providers in the formal and informal sectors. The provision is through Vocational Centres, work-based placements and in schools and colleges. Learners enter TVET programmes from Primary School or though schemes to provide for those who have not been able to complete the Primary Leaving Certificate.

This booklet is about the TVET programmes offered by one of those providers: the specialist TVET Secondary Schools run by the Ministry of Education, Science and Technology (MoEST).

All courses are open to both genders and encourage the participation of girls and women. Courses cater for the whole range of people from those with high academic ability who have successfully completed their primary school course, to those who dropped out of school or were never able to attend.

TVET offers high status courses, valuable qualifications, and entry to employment. It also offers a route to higher education for those people who wish to continue their studies.

The range of courses being offered or developed is wide enough to suit the range of students and their different needs. The range of courses includes:

- Access or catch-up courses, and functional literacy and numeracy for those who have not successfully competed primary education
- Short, medium and long courses that lead to recognized sector qualifications for students who are starting at a higher level
- General courses that allow some students to survey a range of professional options before deciding on one

All courses are practical and industry-related, responding to the latest developments in the sector. They develop the necessary specific sector-related skills, and also the general knowledge, skills and attitudes that student need for employment and for life. Whilst equipping students for a specific vocation they also enable students to develop the capacity to develop and to adapt, and to become life-long learners.

The Specialist TVET Secondary Schools

The specialist TVET secondary schools differ from the mainstream or "academic" secondary in that they offer a vocational option as well as academic subjects.

This is achieved by the specialist TVET secondary schools in S1 & 2 not covering the whole range of academic subjects (see Page 9). This releases time for the vocational subjects. In S3&4 of the specialist TVET secondary schools, students will take the same four compulsory subjects as in the academic secondary schools, but the elective subjects will be vocational.

The syllabuses for the academic subjects that are taken in the specialist TVET Secondary Schools, and the times allocated for them, are the same as in the mainstream or "academic" schools.

The key difference between the vocational courses offered in the specialist TVET secondary schools and those offered in Vocational Centres and Colleges, is that the courses offered in the TVET Schools are the ones with the possibility of leading on to higher education through a diploma to a degree. This is why the curriculum covers academic subjects as well. Not all student will want to progress to higher education, but the possibility must be there.

Vocational courses in the Commercial Secondary Schools are those that might lead on to a degree such as Accountancy or Business Studies; vocational courses in the Agricultural Secondary Schools might lead on to a degree such as Agricultural Science or Soil and Crop Management; vocational courses in Technical Secondary Schools might lead on to a degree such as Mechanical or Electrical Engineering, Building and Construction, Automotive Engineering or Fashion Design.

Students wishing to gain a purely vocational qualification without the option of further study at a higher level will not need the academic side of the curriculum offered in the specialist TVET Secondary Schools. These students will therefore take courses in Vocational Centres of Colleges.

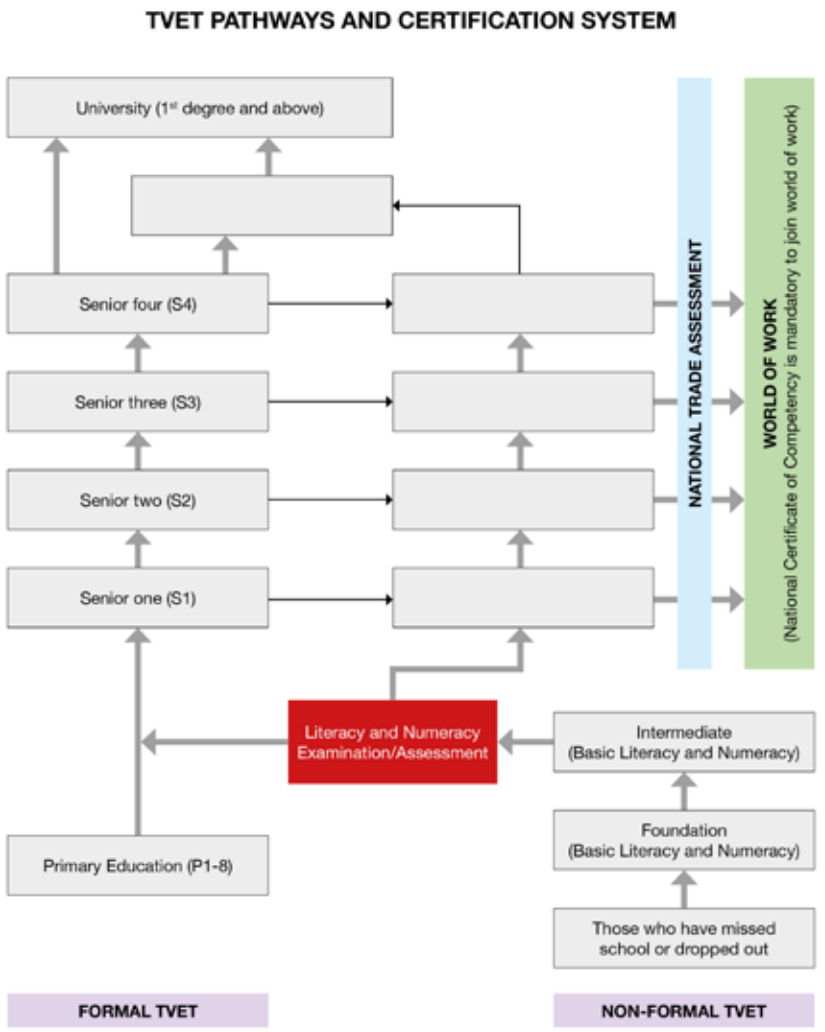
At the moment, there are only five specialist TVET secondary schools, but it is hoped to expand this number. It is also hoped to introduce vocational electives into mainstream schools.

The Vocational Qualifications Framework

Vocational courses fit within an overall Framework of qualifications that has five levels that equate with the years in mainstream schools.

Vocational Level	Academic Equivalent
Level 1: Proficient	S1
Level 2: Artisan	S2
Level 3: Craft	S3
Level 4: Technician	S4
Level 5: Diploma	Polytechnic & colleges

The way this Framework operates is set out in the diagram.



The specialist TVET secondary schools offer Level 1 to Level 4. Each school year from S1 to S4 will lead to a recognized qualification at an appropriate level.

There is also the possibility of leaving school at the end of any year for the world of work or to continue vocational education in a Vocational Centre or College.

There is a set of descriptors that set out the expectations of each level.

Level	Certificate Types	Level Descriptors			
		Problem Solving Capabilities/ Information Processing	Level of Accountability, Responsibility and Autonomy	Level of Knowledge and Skills	Level of Tasks/ Operational Environment
Short Term Training	Foundation Intermediate	• Carry out routine tasks	• Work under guidance	• Basic knowledge and skill	• No complexity of work, very routine level
1	Proficient	• Carry out simple tasks	• Work under direct supervision	• Basic general knowledge - • Ability to apply basic skills	• Competence to work on a defined range of activities under routine and predictable conditions • Low value of complexity, interconnection, in- transparency and dynamics; high degree of stability
2	Artisan	• Use relevant information; solve routine problems using simple rules and tools	• Some autonomy; work under supervision	• Basic factual knowledge of a field of work • Ability to apply basic cognitive and practical skills	• Competence to work on a range of varied activities in a clearly defined context • Average value of interconnection; low value of dynamics
3.	Craftsperson	• Solve problems by selecting and applying basic methods, materials and information	Responsibility for completion of work tasks; some leadership in solution of specific problems	Knowledge of facts, principles, processes and general concepts in a field of work Ability to apply a range of cognitive and practical skills	Competence to adapt own behaviour to circumstances in solving problems; competence to work in a range of roles in a variety of contexts • High value of interconnection, in-transparency and dynamics
4.	Technician	Generate solutions to specific problems in a field of work	Supervise the routine work of others; some responsibility for evaluation and improvement of work activities; leadership and guidance in organizing activities of self and others	Factual and theoretical knowledge in broad contexts within a field of work • Ability to apply expertise in a range of cognitive and practical skills	Competence in self-management within the guidelines of work contexts which are usually predictable, but subject to change; competence to work on a broad range of varied activities and in a wider variety of contexts, most of which are complex and non- routine • Considerably high degree of interconnection, in-transparency and dynamics

The subjects in the specialist Technical secondary schools

The pattern of subjects in the specialist Technical secondary schools is similar to the S3-4 pattern in mainstream schools. English, Maths, Religious Education and Citizenship are compulsory subjects.

Students will take a further three academic subjects from the list offered in mainstream schools. These subjects will be selected to fit with the vocational programme. The syllabuses and time allocated to all these options and the compulsory subjects will be the same as in mainstream schools.

The remaining time (15 periods) will be allocated to the vocational programmes.

All schools will also provide "school programmes" that cover sports and recreation, guidance and community involvement.

This pattern of curriculum will enable Technical school students to transfer to a mainstream school at the end of S2 or S3 if they so desire. Because they will have studied the same four compulsory subjects as mainstream students, they will be able to slot into S3 without a problem. They would then continue the three extra academic subjects they have been studying as their three S3-4 electives.

S1 - 4		
	Status	**Periods per wek (45 minutes each)**
English	Compulsory	5
Maths	Compulsory	5
Religious Education	Compulsory	2
Citizenship	Compulsory	2
School Programmes	Compulsory	2
Academic Options	3 x 3 periods (appropraite to vocational choice)	9
Vocational Options	15 periods	15
	Total	40

Timetables

Schools are free to decide the way in which time is allocated to the subjects. This will depend on the needs of the school and of the programmes. Most vocational programmes have a high practical element that cannot be fitted into a 45 minute period. Therefore schools will put periods together to make longer learning times.

The allocation of periods is for guidance, and the ratios between the subjects could be achieved over a longer period of time than a week.

It is likely that school will wish to allocate a whole morning or afternoon, or even a whole day to vocational programmes. The example below shows the afternoons being allocated to vocational programmes

Of course, this could not work right across the school at the same time, so schools would need to arrange for other year groups to be engaged in vocational programmes in the mornings so that staff and facilities can be allocated effectively. An alternative would be to arrange all-day vocational sessions and spread them across the year groups.

These are only two examples to illustrate the extent of the possibilities here. It is up to schools to organise their own timetables in ways that best suit their needs and circumstances.

	Monday	Tuesday	Wednesday	Thursday	Friday
1					
2					
3					
4					
5					
6					
7					
8					

Key	Academic Subjects	Vocational Programmes

	Monday	Tuesday	Wednesday	Thursday	Friday
1					
2					
3					
4					
5					
6					
7					
8					

Assessment

Assessment of the vocational programmes will be mainly practical, and will be made in accordance with the expected Learning Outcomes set out in the syllabus modules.

Each module also has an "Assessment" section that sets out the sort of evidence expected that a student has met the Learning Outcomes. For example:

Taxation	
S3 Taxation	**Module 4: Business Profit Tax**
Description	By the end of this unit learners will be able to calculate the tax to be paid by a taxable business
Learning Outcomes	1. Understand the basis and application of business profit tax 2. Calculate the tax to be paid by a business on its profits
Elements	Business profit tax as applied in South Sudan and other East African countries
Learning strategies	1. Research from business owner how his/her profit are shared 2. Practice calculation of business profit tax from given exercises
Assessment	1. Written and/or oral explanation of business profit tax 2. Correctly calculate business profit tax

In this example, to find out whether a student "Understands the basis and application of business profit tax", it will be necessary for her or him to give a written or oral explanation. The "Elements" section indicates the amount of understanding expected: in this case how the tax is applied in South Sudan and other East African Countries.

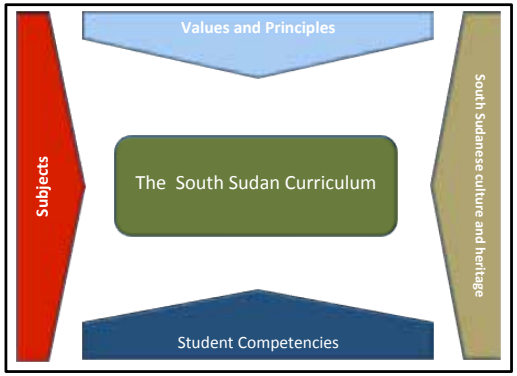
It is important to note that assessments do not always have to be written. Oral evidence is often more valid, and give the teacher the opportunity to probe understanding further. Assessments can also be made as part of the normal process of learning. In the above example, the "Learning Strategies" section suggests that learners should "Practice calculation of business profit tax from given exercises". These exercises will give the teacher good evidence of whether the student can calculate the tax accurately.

Assessment can be both formative to guide learning as it progresses, and summative to determine the extent of learning at the end of a year or programme. Teachers will use formative assessment on an ongoing basis to guide learning.

Summative assessment involves an overall judgement of a student's learning at the end of a module or course.

Because the Vocational Courses in the specialist TVET Secondary Schools are designed to lead on to higher education, the assessment of each level will not necessarily be appropriate for students deciding to leave the course part way through to seek employment. In these cases the students will need to take the qualification assessments used in Vocational Centres and Colleges.

Vocational Programme Overviews



These Vocational Programme Overviews are part of the broader structure of the new curriculum for schools, and should be read alongside the Curriculum Framework. This new curriculum sets out key aims that define what the nation wants for its young people, and these apply to vocational programmes as well as academic subjects. We want young people to become:

- Good citizens of South Sudan
- Successful life-long learners
- Creative and productive individuals
- Environmentally responsible members of society

The new curriculum also put the academic subjects and vocational programmes into a broader context of values, principles, student competencies and the rich culture and heritage of South Sudan. These are all explained in the Curriculum Framework.

The Student Competencies set out in the Curriculum Framework apply to vocational programmes as well as academic subject. In fact, they are the very competencies that employers look for in their employees:

Critical and creative thinking

- Plan and carry out investigations, using a range of sources to find information
- Sort and analyse information and come to conclusions
- Suggest and develop solutions to problems, using their imaginations to create new approaches
- Evaluate different suggested solutions

Communication

- Read and write fluently
- Speak clearly and communicate ideas and information coherently
- Listen to and comprehend speech in a variety of forms
- Comprehend and read critically a variety of types and forms of texts
- Use a range of media to communicate messages, ideas and opinions

Co-operation

- Work collaboratively towards common goals
- Be tolerant of others and respectful of differing views
- Adapt behaviour to suit different situations
- Negotiate, respecting others' rights and responsibilities, and use strategies to resolve disputes and conflicts

Culture & Identity

- Take pride in South Sudanese identity
- Build understanding of South Sudanese heritage in relation to the wider world
- Appreciate and contribute to South Sudanese culture

These four student competencies have been built into the vocational programmes and are a key part of young people's development as members of a workforce that will build the prosperity of South Sudan.

The Syllabus Modules

Each syllabus is divided into modules, and each module is set out in terms of:

Programme	The overall vocational programme
Module Title	The title of the module
Description	The key learning of the module
Learning Outcomes	What the learning is expected to be able to do, know and understand by the end of the module
Elements	The extent of the sector learning that is required
Learning Strategies	The experiences needed to achieve the learning outcomes
Assessment	The ways in which it will be determined whether or not the learning outcomes have been achieved

The full syllabuses are available in a separate document.

Technical Schools

Technical Drawing	S1-S4	22 Modules	432 hours
Automotive	S1-S4	26 Modules	1188 hours
Electrical Installation	S1-S4	14 Modules	1188 hours
Building & Construction	S1-S4	32 Modules	1188 hours
Carpentry and Joinery	S1-S4	18 Modules	1188 hours
Plumbing	S1-S4	20 Modules	1188 hours
Welding	S1 – S4	14 Modules	1188 hours

Technical Schools: Technical Drawing (4 periods per week - 432 hours)			
S1	**S2**	**S3**	**S4**
1.Essentials of technical drawing Draw using different TD lines **2. Tools and Equipment** Produce drawings using tools and equipment appropriately **3. Plane geometry** Divide lines and construct different angles **4. Triangles** Identify and construct different types of triangle **5. Quadrilaterals** Construct quadrilaterals **6. Polygons** Construct various types of polygon **108**	**1. Circles, arcs and tangency** Construct circles, arcs and tangents and relate these to their use in engineering **2. Loci** Construct loci and relate their use to engineering works **3. Solid geometry** Construct geometrical shapes and relate them to engineering works **4. Symbols and Abbreviations** Use the basic symbols and abbreviations correctly **81**	**1. Orthographic projection** Construct and interpret orthographic projection drawings **2. Dimensioning of engineering drawing** Construct dimension engineering drawings based on the unit used **3. Isometric projection** Draw isometric axes and distribute the dimensions appropriately. **4. Oblique projection** Identify the difference between oblique and isometric projection and determine the true shape of components **5. Sectioning** Clarify internal detail of an object and use sectional line lines appropriately **81**	**1. Free hand sketching** Sketch engineering components without the use of drawing instruments **2. Fasteners (Mechanical only)** Select and use appropriate methods to join (secure) engineering components **3. Interpretation of solid** Trace out the exact point of intersection of different solids **4. Development of surface** Visualize, calculate and accurately draw surface development of engineering components **5. Further problems in orthographic projection** Read assembly drawings, design simple items and incorporate other concept covered earlier into their work **6. Building Plans (Civil only)** Understand and interpret building plans and working drawings **7. Bill of quantity (Civil only)** Understand the difference between a bill of quantity and a specification and write a bill of quantity, following the correct procedure **108**

Technical Schools: Automotive (11 periods per week. 1188 hours)			
S1	**S2**	**S3**	**S4**
1. Safety Precautions Understand how to use basic tools safely **2. Layout of motor vehicle** Understand and explain the layout of the components of a motor vehicle **3. Basic engine terms** Understand and explain different terms used in automotive engine **4. Moving and stationary components of engines** Identify and understand the functions of different components of an engine **5. Otto - cycle of four stroke petrol engine** Understand and demonstrate operation of engine cycle in petrol engine **6. Two stroke engine cycle** Understand and demonstrate the principles of the two stroke cycle **7. Wheels and Tyres** Understand different types of wheel and tyres. **297**	**1. Cylinder head** Understand and explain the components and working parts of the unit **2. Types of engine** Understand and demonstrate various types of engines **3. Lubrication systems** Understand the components of lubrication systems, their principles, operation and maintenance **4. Cooling systems** Understand and explain the function of components of the cooling system **5. Final drive, differential unit** Understand and explain the functional principle of the differential unit **6. Ignition systems** Understand and maintain various part of the ignition circuit **297**	**1. Suspension system** Understand and demonstrate the operating principle of the suspension system **2. Steering System** Understand and service the different types of steering system **3. Clutch system** Understand the operation of the clutch and its components and will be able to troubleshoot faults **4. Gearbox** Understand and maintain the different types of gear train **5. Braking System** Understand the function of and service brake systems **6. Fuel System** Understand the operation of fuel system (petrol) and electronic fuel injection, and service fuel systems. **297**	**1. Compression Ignition System (CI)** Understand the principle and operation of compression ignition engines **2. Two-stroke cycle (CI)** Understand the components, principle of operation and maintenance of the two stroke-cycle C.I. **3. Fuel injector system (CI engine)** Understand the components, principle, operation and maintenance of fuel injection systems **4. Alternator/Magneto** Understand the working principle of the alternator and carry out maintenance **5. Starter Motor** Understand the principle and components of electric starters, service and rectify faults **6. Lighting Systems** Understand the lighting and wiring in automotives and troubleshoot faults **7. Battery** Understand the principle, operation, types and construction of the battery and be able to carry out maintenance. **297**

Technical Schools: Electrical Installation (11 periods per week - 1188 hours)			
S1	**S2**	**S3**	**S4**
1. Health and Safety Select the right tools and equipment for various tasks and uses them appropriately, observing all the safety rules to avoid injury and harm. **2. Ohm's Law** Understand the practical applications of Ohm's Law **3. Measuring Instruments** Apply and use different types of electrical measuring Instruments and determine the measurement error **4. Electrical Symbols** Draw the standard symbols used in electrical installation **5. Types of Current** Identify types of current and their uses **6. Conductors & Colour Code** Explain and select and use the appropriate colour code **7. Electrical Diagrams** Classify and use the correct electrical diagrams in different circuits **297**	**1. Electrical Circuits** Connect DC circuits in different ways **2. Circuit Parameters** Verify circuit parameters **3. DC and AC Current** Identify the wave form of DC and AC systems and be able to connect different circuits **4. Switches and Switch Outlets** Identify different types of switches and connect correctly the terminals to the conductor **5. Socket Outlets** Verify and install socket outlets **6. Lamps and Light Fittings** Install different types of light fittings **7. Switchgears** Understand different types of switch-gears and connect accordingly **8. Fans** Identify and connect different types of fans. **297**	**1. Magnetism** Understand the key principles of magnetism **2. Electromagnetism** Identify direction of lines of magnetic force and effect of electric current. **3. Electrical Transmission** Identify different type of energy sources, distribution systems, power transmission and power distribution. **4. Distribution Systems** Identify and install different types of distribution system **5. Domestic Wiring** Understand domestic wiring and connect correctly by using particular circuit diagrams **297**	**1. Kirchoff's Laws** Understand Ohm's and Kirchhoff's laws and be ale to calculate the values of resistance, current and voltage by using them **2. Application of Kirchoff's Laws** Apply Kirchhoff's Laws in branch and Maxwell's Loop current and Nodal voltage method **3. Generators** Identify, dismantle, sketch and assemble generators accessories. **4. Rotary Machines** Identify parts and connections of start run and reverse motor direction **5. Relays and Contactors** Identify and connect different types of relays and contactors **297**

Technical Schools: Building and Construction (11 periods per week – 1188 hours)			
S1	**S2**	**S3**	**S4**
1. Building construction and concrete practice Understand key elements of building construction and concrete practice **2. Safety rules and regulations** Understand safety rules and regulations and apply them accordingly **3. Tools and equipment** Understand tools and equipment, their groups, uses, and be able to apply them appropriately **4. Building materials** Understand building materials, identify the types, uses and apply correct practice when using them **5. Bonding and its rules** Identify types of bonds, materials, tools used, and apply the methods in practice **297**	**1. Tools and equipment** Understand the importance of tools and equipment, types and how to use them safely **2. Production of building materials** Understand the production of building materials, types, classifications and use of each building material **3. Setting out building layout plans** Understand the measurements; the scales used and demonstrate the procedures of setting the plan on the ground **4. Foundations 1** Understand the methods of constructing foundations **5. Walls** Understand the materials applied to different kinds of walls, and the methods of construction for each. **6. Opening in walls** Identify types of openings, the materials used and methods of creating openings in walls. **7. Lintels** Explain the purpose of lintels, the materials used and methods of construction. **8. Decorative panels** Select materials and construct decorative panels. **9. Copings** Understand how to construct copings. **297**	**1. Foundations 2** Identify and construct an appropriate type of foundation for each type of soil **2. Drainage systems 1** Identify the type of the drainage system and lay-out needed for a site. **3. Cavity and solid walls** Understand the bonding, purpose for which cavity and solid walls are used in building construction **4. Bridging over openings** Understand the types, span of openings, and the purposes of bridging, the materials applied, and the methods used for respective construction **5. Rocks** Understand the geological formation of rocks, stone quarrying and their uses for specific construction purposes **6. Wall finishes** Understand the conditions of internal and external walls surfaces where appropriate tools and materials are applied **7. Matrix /cement and Lime** Understand the chemical reaction of cement and lime used in construction as binding materials **8. Concrete** Understand the types of materials used in concrete, identify formwork and demonstrate the methods of concreting.	**1. Arches** Demonstrate methods of construction of each type of arch in appropriate positions. **2. Drainage systems 2** Lay out drain pipes, test to identify blockages and leaks, and ensure correct flow **3. Fireplaces** Understand the types and materials used, understand and apply the methods of construction of fireplaces. **4. Floors** Demonstrate the methods of constructing various types floors **5. Retaining walls** Construct different types of retaining walls **6. Fabricated structures** Design formwork according to the purposes of construction **7. Landscapes** Design and carry out landscaping **8. Wood wall structures** Design and construct wood walls **9. Drawing software** Use appropriate software for design **10. Calculations and estimates** Make estimates, calculate quantities and make bills of quantities

Technical Schools: Building and Construction (11 periods per week – 1188 hours)			
S1	**S2**	**S3**	**S4**
		9. Scaffolding Understand methods of constructing various types of scaffolding. **10. Shores** Understand types of shores, and identify where and how shores are used in building constructions **11. Block Work** Understand the standard measurement, materials and equipment applied in moulding blocks **12. Staircases** Understand the functional requirement and demonstrate the methods of construction **297**	**11. Roofs** Identify the type of roof needed for a building, and the appropriate methods of construction. **297**

Technical Schools: Carpentry and Joinery (11 periods per week - 1188 hours)			
S1	**S2**	**S3**	**S4**
1. Important principles of carpentry and joinery. Understand the key principles of carpentry and joinery **2. Workshop safety rules.** Comply with safety rules to avoid accidents in the workshop **3. Hand tools.** Use competently a range of hand tools **4.Timber and trees.** Identify the types of timber trees grown in different countries and understand the classes, uses and values of their wood **297**	**1. Timber Tree Growth** Understand the structure of timber trees, the process of growing them and their uses **2. Hardwood and Softwood Timber** Distinguish the types of wood and explain their uses and safe storage **3. Conversion of Timbers** Understand the tools and equipment used in the process of conversion **4. Wood preservation** Identify the types of preservatives and their uses and understand the methods of wood preservation **5. Timber Seasoning** Understand the reasons for seasoning, and the methods of seasoning and storage **6. Joints** Identify the various types joints and demonstrate practical operations on framing and assembling joints **297**	**1. Woodworking Machines** Understand safety regulations and use machines appropriately **2. Doors and windows** Make and fix doors and windows **4. Portable power hand tools** Observe safety rules and use tools appropriately **4. Scaffolding** Understand the types of scaffolding and how they are used safely **297**	**1. Roofs** Identify different type of roofs, understand roof terminology and set out roof trusses **2. Arches and centres** Identify the types of arch, and understand their function in building **3. Formwork** Understand how to make temporary formwork **4. Partitions** Understand how to construct partitions **5. Stairs** Understand the function and construction of stairs **297**

Technical Schools: Plumbing and Pipefitting			
S1	**S2**	**S3**	**S4**
1. Introduction to Plumbing Understand the purposes of a plumbing system and use basic plumbing tools **2. Safety** Understand safety rules and apply them in practice. **3. Basic Tools** Understand the purpose and use of the basic tools and equipment, and will be able to use them appropriately **4. Basic Plumbing Materials** Understand the purposes of plumbers' materials, identify their types and uses and apply correct practice when using them	**1. Taps and Valves** Understand types of taps and valves, and be able to install them **2. Sanitary Fittings** Know the types of sanitary fittings, will be able to identify the correct positions for fittings, and will be able to demonstrate correct methods for fitting the various types of fittings. **3. Water Distribution Systems** Know the two distinct systems for carrying water to a building from the main and will know how to install pipes to the main **4. Cold Water Supply** Know the two types of systems for conveying cold water around a building and understand the functional requirements of cold water storage. **5. Hot Water Supply** Understand the two systems for providing hot water in a building, and the functional requirements of hot water storage cylinders **6. Sheet Metal Work** Understand the types and usage of sheet metal, and the tools and equipment used	**1. Drainage** Understand drainage systems, identify the positions where drainage systems are set and know the appropriate materials. **2. Above-ground Drainage** Understand the composition above ground sanitary pipe work systems, and be able to connect the pipes used. **3. House Drainage** Understand the four systems for plumbing house drainage, and fix the pipes using the correct methods. **4. Below-ground drainage** Understand the types and composition of pipes used below ground and the tools used for the installation **5. Sheet Lead Work** Understand the use of sheet lead, how it is handled and used and the safety precautions adopted during the practice.	**1. Welding** Understand the different types of welding, the tools, equipment, materials and methods used in welding and will be able to apply their skills in practice. **2. Plumbing Software** Understand plumbing service software, its advantages, types of service software and how to use the software in practice. **3. Traps** Understand the purposes of a trap, the types of traps, the materials and the methods used for installation. **4. Sewage Systems** Understand the importance of sewage disposal, the types of sewage disposal facilities, and the materials and methods used in construction of sewage facilities. **5. Trenching Systems** Understand trenching for pipelines, types of timbering of trenches suitable for different soil types and will be able to make trenches safely

Technical Schools: Welding			
S1	**S2**	**S3**	**S4**
1. Bench Work Carry out bench work using a range of tools and machines and make a simple object using these tools. **2. Health and Safety** Know how to work safely in the workshop, know basic first aid and understand how to use a fire extinguisher **3. Workshop Calculation** Carry out and make use of basic mathematical calculations in the workshop **4. Equipment and tools** Identify and use welding tools and equipment and know its application in the workplace	**1. Material Science** Understand engineering materials and the principles of heat treatment of metal, and identify different materials correctly. **2. Essentials of welding** Carry out welding techniques in various applications and positions and produce a product **3. Hand Forging** Use the tools and equipment used in hand forging to design and produce a simple tool, and understand the use of decorative work. **4. Sheet Metal Work** Understand sheet metal work and apply this to design and make an object	**1. Gas Welding** Carry out gas welding procedures **2. Machine Tools** Understand the different types of machines for different purposes **3. Difficulties and defects in welding** Understand the problems associated with arc and gas welding, understand the defects that can occur and know how to correct them. **4. Electrodes for Manual Arc Welding** Use electrodes appropriately	**1. Production and Fabrication** Design and make a product using welding **2. Foundry Work** Carry out casting work using a range of materials and including decorative work.

Mechanical Engineering: Automotive

Mechanical Engineering: Automotive	
S1	**Module 1: Safety Precautions**
Description	By the end of this module learners will be able to understand how to use basic tools safely.
Learning Outcomes	1. Identify different types of basic tools and demonstrate their uses 2. Demonstrate safety awareness (risks and precautions) that is required in motor vehicle shop 3. To be able to apply safe working principles and practice in the workshop including use of fire-fighting equipment
Elements	1. Tools: hammers, spanners, wrenches, screw drivers, vices, anvil, drills, grips and pliers 2. Risks: Fuel, oil, fire, jacking up vehicles, air compressor, grease 3. Precautions: Safety clothing: gloves, goggles, safety shoes, overalls, tidiness, cleanliness 4. Avoidance of accidents, dealing with accidents and emergencies, including fire
Learning Strategies	1. Discuss in groups the different types of tools, learning their names and their functions; make presentations 2. Practise the safe usage of the named tools 3. Discuss the safety rules of the workshop, relating each to potential risks and how dangers are avoided; make presentations of safe practice 4. Practise application of safe working principles and practice and dealing with accidents and emergencies
Assessment	1. Written or oral explanation of different types of tools and their uses, observation of correct use 2. Written or oral explanation of safety awareness (risks and precautions) required in motor vehicle shop 3. Observation of safe working principles and practice in the workshop including use of fire-fighting equipment

Mechanical Engineering: Automotive	
S1	**Module 2: Layout of Motor Vehicles**
Description	By the end of this module learners will be able to understand and explain the layout of the components of a motor vehicle.
Learning Outcomes	1. Explain the different major components of motor vehicles and their functions 2. Demonstrate understanding of the layout of a motor vehicle and how the components interact to make a working vehicle
Elements	1. Different components of the vehicle: Chassis, body, power unit, transmission system, suspension system, braking system, steering system, electrical system, tyres and wheels 2. Functions and layout of each component listed in 1 above
Learning Strategies	1. In groups, use a range of sources (hands on experience, video, workshop visits, manuals, etc.) explore the different component and their functions; make presentations 2. Group work discussing the working principles of the whole motor vehicle and group presentations relating to the interaction of each component
Assessment	1. Written or oral explanation of different components of motor vehicles and their functions 2. Written or oral explanation of layout of motor vehicle and how the components interact to make a working vehicle

Mechanical Engineering: Automotive	
S1	**Module 3: Basic Engine Terms**
Description	By the end of this module learners will be able to understand and explain different terms used in automotive engine
Learning Outcomes	1. Explain the different terms used in automotive engine 2. Demonstrate understanding of the terms and be able to use them to explain the operation of an engine
Elements	1. Terms: Bore, stroke, compression ratio, capacity, top/bottom dead centres, volumetric efficiency, thermal efficiency, mechanical efficiency and torque 2. Use of the terms in relation to effective and efficient functioning of an engine
Learning Strategies	1&2. Practise using the terms correctly in relation to the effective and efficient operation of automotive engines
Assessment	1. Written or oral explanation of each of the different terms used in automotive engine 2. Written or oral explanation of the operation of an automotive engine, using the terms correctly

Mechanical Engineering: Automotive	
S1	**Module 4: Moving and Stationary Components of Engines**
Description	By the end of this module learners will be able to identify and understand the functions of different components of an engine
Learning Outcomes	1. Identify different components of an engine 2. Explain functions of different engine components and how the components combine to make a working engine
Elements	1. Components of an engine: (a) Movable parts: piston assembly, crank shaft, cam shaft, connecting rod, fly wheel, valve mechanism (b) Stationary parts: Cylinder block, cylinder head, oil sump, bearings, seal, gasket, cylinder liner, core plug, oil pump 2. Functions of each component and overall working of an engine (Refer to terms in Module 3: Bore, stroke, compression ratio, capacity, top/bottom dead centres, volumetric efficiency, thermal efficiency, mechanical efficiency and torque)
Learning Strategies	1. Discuss in groups the different movable and stationary component engine and their functions and presentation. 2. Practise explaining the functions of different engine components and how they combine in a working engine; make a presentation
Assessment	1. Written or oral explanation of different components of an engine. 2. Written or oral explanation of the separate functions of different engine components and of the overall operation of the whole engine

Mechanical Engineering: Automotive	
S1	**Module 5: Otto-cycle (Four Stroke) Petrol Engine**
Description	By the end of this module learners will be able to understand and demonstrate operation of engine cycle in petrol engine
Learning Outcomes	1. Explain the principle of Otto cycle 2. Demonstrate understanding of the operation of the Otto cycle in petrol engines referring to actual engine components
Elements	1. Principle of Otto-cycle: pressure-volume diagram, piston, cylinder, crank shaft, inlet valve and exhaust valve, connecting rod, spark plug, carburetor, air and fuel 2. Components and their functions
Learning Strategies	1. Group discussion on the principle of Otto cycle; make presentation 2. Practise explaining the operation of the Otto cycle in petrol engines referring to actual engine components.
Assessment	1. Written or oral explanation of the principle of Otto cycle 2. Written or oral explanation of the operation of the Otto cycle in petrol engines referring to actual engine components

Mechanical Engineering: Automotive	
S1	**Module 6: Clark or Two Stroke Engine Cycle**
Description	By the end of this module learners will be able to understand and demonstrate the principles of the two stroke engine cycle
Learning Outcomes	1. Explain the principle and operation of the two stroke cycle 2. Compare the operation of the two stroke and four stroke cycles 3. Understand and demonstrate the operation of the two stroke cycle in a motor vehicle
Elements	1. Operation of two stroke cycle (theory): pressure-volume diagram, inlet, exhaust and transfer ports, scavenging, dilution of fuel and oil 2. Comparison: ports and valves, fuel consumption, thermal efficiency, power output, stroke 3. Operation of the two stroke cycle (practical demonstration)
Learning Strategies	1. Working in groups, discuss the operation of two stroke cycle engines; make a presentation 2. Group work to discuss and agree the differences between two stroke and four stroke cycles; make a presentation
Assessment	1. Written or oral explanation of operation of the two stroke cycle 2. Written or oral comparison of the operation of two stroke and four stroke engines 3. Observation of practical demonstration of understanding of the principles of two stroke cycle in motor vehicle

Mechanical Engineering: Automotive	
S1	**Module 7: Wheels and Tyres**
Description	By the end of this module learners will be able to understand different types of wheel and tyres and their uses and will be able to service them and troubleshoot problems.
Learning Outcomes	1. Identify different types of wheels and tyres and explain reasons for choosing each 2. Be able to service wheels and tyres and to troubleshoot problems
Elements	1. Types of wheels: spoked, steel, alloy Types of tyre: cross ply, radial ply, tube tyre, tubeless 2. Carry out routine servicing; identify and rectify common problems related to wheels and tyres
Learning Strategies	1. Observing and identifying the different types of wheels and tyres, research their uses; produce a report 2. Practise servicing different wheels and tyres, identifying and rectifying common problems; make a presentation
Assessment	1. Written or oral explanation of the different types of wheels and tyres and the reasons for using each 2. Observation of skills in servicing wheels and tyres and in identifying and rectifying problems; written or oral explanation of servicing routines and of trouble-shooting problems with wheels and tyres

Year 2

Mechanical Engineering: Automotive	
S2	**Module 1: Cylinder head**
Description	By the end of this module learners will be able to understand and explain the components and working parts of the unit
Learning Outcomes	1. Describe the working principles of the cylinder head components 2. Service the cylinder head and troubleshoot problems
Elements	1. Cylinder head: inlet and exhaust valves, rocker mechanism, gasket, cylinder head bolts, oil seals, water jacket, oil gallery 2. Troubleshooting and maintenance: dismantling and assembling, grinding valves, replacing seals, decarbonisation and valve adjustment
Learning Strategies	1. Discuss in groups the working principle of the cylinder head and the functions of its components; make a presentation 2. Practise cylinder head servicing and troubleshooting problems.
Assessment	1. Written or oral explanation the working principles of the cylinder head and the functions of its components 2. Observation of skills in servicing of the cylinder head and in troubleshooting problems

Mechanical Engineering: Automotive	
S2	**Module 2: Types of Engines**
Description	By the end of this module learners will be able to identify various types of engines and demonstrate understanding of their structure and function
Learning Outcomes	1. Identify different types of engines, explain the distinguishing features of each and their advantages and disadvantages 2. Apply understanding of the various types of engine to identify them in practical situations and explain their features
Elements	1. Types of Engine in terms of fuel (petrol, diesel and gas), in terms of configuration (line engine, horizontal engine, V- engine, rotary engine) and in terms of cooling (water and air cooling), key features and advantages / disadvantages 2. Practical demonstration of understanding: identify and explain the types of engine with reference to fuel, configuration and cooling
Learning Strategies	1. Group work: with reference to a range of resources, discuss the different types of engines, their key features and their advantages and disadvantages; make a presentation 2. Group work practising identification of various types of engine in the workshop through understanding of the structural differences associated with different fuels, configurations and cooling methods
Assessment	1. Written or oral explanation of the different types of the engines, their features and advantages/disadvantages 2. Observation of skills in correctly identifying the various types of engine in practical situations and explaining the reasons for the identification

Mechanical Engineering: Automotive	
S2	**Module 3: Lubrication Systems**
Description	By the end of this module learners will be able to understand the principles and types of lubrication systems, the components and their functions and will be able to carry out routine maintenance.
Learning Outcomes	1. Describe the principles of the lubrication system, the types of lubrication system and the structure and functions of the components 2. Carry out routine maintenance of lubrication systems
Elements	1. Lubrication system principle: improved engine efficiency, reduced wear and cost Types: splash and forced (pressurized) type, dry sump type, diluting system Component of lubrication system: lubricating oil, sump, oil pump, oil filter, oil gallery, oil pipes, oil gauge, viscosity and viscosity index 2. Maintenance: check / change oil filter, change oil, replace oil seal, replace oil gasket, service the oil pump, flush oil lines (practical)
Learning Strategies	1. In groups, discuss the working principle and types of engine lubrication systems, the components and their functions 2. Group work: practise the maintenance of lubrication systems
Assessment	1. Written or oral explanation of the principles and types of lubrication system and the structure and functions of the components; make a presentation 2. Observation of skills required in routine maintenance of lubrication systems

Mechanical Engineering: Automotive	
S2	**Module 4: Cooling Systems**
Description	By the end of this module learners will be able to understand and explain the principles of cooling systems, the functions of components and to carry out maintenance and troubleshooting
Learning Outcomes	1. Outline the principle and the purpose of cooling systems 2. Describe the construction and operation of the main parts in liquid and air cooling systems 3. Service and troubleshoot cooling systems
Elements	1. Principle and purpose of cooling systems: engine temperature regulation for efficient, safe operation 2. Construction and operation of: thermostat, water pump, cooling fan, water hose, drive belt, fins, radiator, blower 3. Maintenance: tension the belt, water level, fin, thermostat testing, rectify water leaks, service water pump, service radiator (practical) Troubleshooting: leaks, blockages, overheating
Learning Strategies	1. In groups, discuss the working principle of the engine cooling systems and the impact of failure of a cooling system; produce a guide / report 2. Group work: discuss the construction and operation of the main parts in liquid and air cooling systems and make presentation to explain 3. Practise servicing cooling systems and troubleshooting problems
Assessment	1. Written or oral explanation of the principle and purpose of cooling systems 2. Written or oral explanation of the construction and operation of the main parts in liquid and air cooling systems 3. Observation of skills in routine servicing of cooling systems and in troubleshooting problems

Mechanical Engineering: Automotive	
S2	**Module 5: Final drive differential unit**
Description	By the end of this module learners will be able to understand and explain the principle of the differential unit, its components and their functions
Learning Outcomes	1. Explain the functional principle of the differential unit 2. Describe the components, construction and operation of rear hub assemblies 3. Carry out routine maintenance of the differential unit
Elements	1. Principle: transmission of drive from the engine to the wheels allowing the wheels to turn at different speeds, importance of this feature 2. Functional components: Crown wheel, pinion, planet gear, sun gear, spider shaft, half shaft Construction and operation: rear hub assembles (semi floating, three quarter floating, fully floating) 3. Maintenance: pinion weight, backlash, pinion, pre-loading, tooth contact
Learning Strategies	1&2. Discuss in groups the functional principle of the differential unit, its functional components and the construction and operation of rear hub assemblies; produce a presentation 3. Practise servicing and routine maintenance of the differential unit
Assessment	1. Written or oral explanation of functional principle of the differential unit and its importance 2. Written or oral explanation of the components of the differential unit and the construction and operation of rear hub assemblies 3. Observation of skills in routine maintenance of the differential unit

Mechanical Engineering: Automotive	
S2	**Module 6: Ignition System**
Description	By the end of this module learners will be able to understand and maintain various parts of the ignition circuit.
Learning Outcomes	1. Understand the principle of ignition circuits 2. Explain the structure and function of the parts of the ignition circuit 3. Maintain and repair the ignition circuit
Elements	1. Principle: Electromagnetic induction to create sparks to ignite fuel 2. Parts: battery, ignition switch, ignition coil, distributor, contact breaker point, condenser, high tension cable, low tension cable, spark plug 3. Maintenance and repair: replace the coil ignition, adjust and replace contact breaker points, replace the condenser, clean and replace the spark plug, change the high tension cable
Learning Strategies	1. Discuss in group the principle of ignition circuits; make a presentation 2. Group work: discuss the structure and functions of the parts of the ignition circuit 3. Practise servicing the ignition circuit
Assessment	1. Written or oral explanation of principle of ignition circuits 2. Written or oral explanation of the structure and function of the parts of the ignition circuit 3. Observation of skills in routine servicing, maintenance and repair of the ignition circuit

Year 3

Mechanical Engineering: Automotive	
S3	**Module 1: Suspension Systems**
Description	By the end of this module learners will be able to understand how suspension systems work and will be able to carry out maintenance and repair
Learning Outcomes	1. Explain the operating principle of suspension systems 2. Describe different types of suspension system, the components and their functions 3. Practical maintenance, troubleshooting and repair
Elements	1. Principle: to maximize friction between tyres and road and to absorb shock and vibration and so protect vehicles, passengers and goods 2. Types: dependent, independent, front, rear – McPherson strut, double-wishbone Components: shock observer, rubber springs, leaf springs, coil spring, air spring and functions of each 3. Maintenance and repair: test and change springs, replace shock absorbers
Learning Strategies	1. Discuss in groups the operating principle of suspension system and make presentations 2. Group work discussing the different types of suspension system, the components and their functions and make presentations 3. Practise maintenance of suspension systems, troubleshooting of problems and repair
Assessment	1. Written or oral explanation of the operating principle of suspension system 2. Written or oral explanation different types of suspension system, the components and their functions 3. Observation of skills used in maintenance, troubleshooting and repair of suspension systems

Mechanical Engineering: Automotive	
S3	**Module 2: Steering System**
Description	By the end of this module learners will be able to understand the principles and types of steering system and carry out servicing and repairs
Learning Outcomes	1. Explain working principles of different types of steering system 2. Explain clearly Ackerman's principle 3. Describe the geometry of steering system 4. Service and repair different types of steering system
Elements	1. Principles of types of steering system: mechanical and hydraulic; rack and pinion, recirculating ball, power steering 2. Ackerman's principle and layout: transverse and longitudinal drag link, track rod, split track 3. Steering geometry: toe-in, toe-out (tyre grip), centre point steering, castor, camber, king pin inclination, slip angles, over-steer and under-steer 4. Maintenance and repair: inspect and repair steering box, rectify any defect in the system
Learning Strategies	1. In groups, research and discuss the working principle of different types of steering system and make presentations 2. Working in groups, discuss the Ackerman's principle and make presentations 3. Working in groups, discuss the geometry of steering systems and make presentations 4. Practise servicing and repair different types of steering systems
Assessment	1. Written or oral explanation of the working principle of different types of steering system 2. Written or oral explanation of Ackerman's principle 3. Written or oral explanation the geometry of steering systems 4. Observation of practical servicing and repair of different types of steering system

Mechanical Engineering: Automotive	
S3	**Module 3: Clutch System**
Description	By the end of this module learners will be able to understand the operation of the clutch and its components and will be able to troubleshoot faults
Learning Outcomes	1. Explain the working principle of a clutch system 2. Identify different components of the clutch system and their functions 3. Detect faults and repair
Elements	1. Working principle for a hydraulic clutch: engagement and disengagement of drive from wheels 2. Parts of the clutch: hydraulic fluid, clutch plate, pressure plate, sleeve cylinder, fixed and flexible pipe, master cylinder, release bearing 3. Servicing: assemble and disassemble the clutch: mechanical, cable and rod Troubleshoot: bleeding, inspection of clutch plate and pressure plate, change of spring, fracture of the pipe
Learning Strategies	1. In groups, discuss the working principle of clutch system and make presentations 2. Group work discussing the different components of the clutch and their functions; make presentations 3. Practise servicing and repairing clutch faults
Assessment	1. Written or oral explanation of the working principle of a clutch system 2. Written or oral explanation of different components of the clutch and their functions 3. Observation of skills in servicing and repairing faults

Mechanical Engineering: Automotive	
S3	**Module 4: Gearbox (Gear Train)**
Description	By the end of this module learners will be able to understand the different types of gear train, the working principle, the associated terms, the components and their functions and will be able to carry out maintenance and troubleshooting
Learning Outcomes	1. Describe the types and working principle of the gearbox and related terms 2. Explain the component and functions of gear trains and understand the functions of the components. 3. Be able to carry out servicing, detect and remedy faults in the gearbox
Elements	1. Types of gearbox: Hydraulic and manual gearbox Working principle: to change the speed and torque of vehicle according to road and load conditions Terms: gears, shaft, gear ratio, speed, fuel efficiency 2. Components of gear train: sliding mesh, constant mesh, synchromesh, planetary, selector mechanism: selector fork, selector détente, interlocks mechanism; functions of each 3. Maintenance: Change fluid, inspect plugs, seals and bushes; detect and remedy: oil leakage, noisy gears, slipping
Learning Strategies	1. In groups, discuss the types and working principle of gearboxes and related terms; make presentations 2. Discuss in groups the components of gearboxes and their functions and make presentations 3. Practise servicing and detecting and remedying faults
Assessment	1. Written or oral explanation of the types and working principle of the gearbox and the associated terms 2. Written or oral explanation of the components of gearboxes and their functions 3. Observation of application of skills in servicing and remedying faults in gearboxes

Mechanical Engineering: Automotive	
S3	**Module 5: Braking System**
Description	By the end of this module learners will be able to understand the function of braking systems and carry out maintenance and repair
Learning Outcomes	1. Understand the purpose, layout and operation of braking systems 2. Describe the components of braking system and their functions 3. Service brake system and troubleshoot problems.
Elements	1. Purpose: to control speed of a vehicle by slowing or stopping Layout of braking system: reservoir, master cylinder, single piston, double type (tandem), fixed and floating wheel cylinder, brake pipe, wheel cylinder 2. Construction and operation of brake system: Drum brake - leading and trailing shoes, two leading brake shoes, anchor and adjuster, fixed cam, floating anchor, expander and adjuster; Disc brake - single and double piston Operation of hand brake: rod and pivot, lever push rod and cam lever 3. Maintenance: bleeding, changing fluid, changing shoes Repair: master and wheel cylinder
Learning Strategies	1. Group work: using a range of sources, discuss the purpose, layout and operation of braking systems, including functions of single and tandem master cylinders: make presentations 2. Group work: discuss the construction and function of the parts of the braking system and make presentations 3. Practice servicing brake system and troubleshoot problems
Assessment	1. Written, sketched or oral explanation of the purpose, layout and operation of braking systems including both single and tandem master cylinders 2. Written or oral explanation of the components of braking systems and their functions 3. Observation of practice in servicing brake system and troubleshoot problems

Mechanical Engineering: Automotive	
S3	**Module 6: Fuel System**
Description	By the end of this module learners will understand the operation of petrol fuel systems and electronic fuel injection and will be able to service fuel systems
Learning Outcomes	1. Describe the purpose of fuel systems in spark ignition (S.I.) engines and the need for control of the composition of the petrol / air mixture that is drawn into cylinders; understand the impact of different mixtures 2. Describe fuel system components and explain their functions 3. Explain the principles of the electronic fuel injection system 4. Service and repair of components of the fuel system
Elements	1. Purpose: delivery of fuel to cylinders and mix an appropriate ratio of petrol to air; impact of incomplete combustion of fuel on efficiency and pollution 2. Fuel system components and their functions: electronic fuel injection unit, fuel tank, fuel pipes, fuel filters, feed (fuel) pump, carburettor, air cleaners, inlet manifolds 3. Differences between principles of fuel injection system and carburettors 4. Maintenance and repair: routine maintenance and repair of common faults
Learning Strategies	1. In groups, discuss the purpose of fuel systems and the composition of the petrol/air mixture that is drawn to cylinders and make a presentation 2. In groups, discuss the fuel system components and their functions and make a presentation 3. In groups, discuss the principle of the electronic fuel injection system, compared to a carburetor and make a presentation 4. Practise servicing fuel systems and repairing components
Assessment	1. Written or oral explanation of the purpose of fuel systems and the significance of the composition of the petrol / air mixture that is drawn into cylinders 2. Written or oral explanation of fuel system components and their functions 3. Written or oral explanation the principles of the electronic fuel injection system 4. Observation of skills in servicing fuel systems and repairing components

Year 4

Mechanical Engineering: Automotive	
S4	**Module 1: Compression Ignition C.I. (Diesel Engine)**
Description	By the end of this module learners will be able to understand the principle and operation of compression ignition engines
Learning Outcomes	1. Explain the working principle of the diesel engine (four stroke) and the term compression ignition (C.I.) 2. Understand the layout of a compression ignition fuel system, its components and their functions and relate it to a spark ignition (S.I.) engine 3. Explain the structure and functions of the two types of (C.I.) combustion chamber 4. Service and test the major components in the diesel engine fuel system
Elements	1. Working principle: self-ignition, compression ratio, atomization, glue plug 2. Major components: fuel tank, fuel pipe, fuel filter, feed pump, main pump, pressure pipe, atomizer 3. Structure and function: direct and indirect combustion chamber 4. Service and test: routine service, test and repair injector nozzle, fuel pump, bleeding and repairing common faults
Learning Strategies	1. In groups, discuss the working principle of the diesel engine (four stroke) and the term compression ignition and make a presentation 2. In groups, discuss the layout of a compression ignition system, its components and their functions and relate it to S.I engine and make a presentation 3. In groups, discuss the structure and function of the two types of combustion chamber and make a presentation 4. Practice servicing, testing and repair: routine service, test and repair injector nozzle, fuel pump, bleeding to remove air and repairing other common faults
Assessment	1. Written or oral explanation of the working principle of the diesel engine and the term compression ignition 2. Written, oral or drawn explanation of the layout of a compression ignition system, giving the function of each component and relate it to an S.I. engine 3. Written or oral explanation or sketch of the structure and function of the two types of combustion chamber 4. Observation to assess skills in servicing, testing the major components of the diesel engine fuel system and carrying out repairs

Mechanical Engineering: Automotive	
S4	**Module 2: Two Stroke Cycle (C.I.)**
Description	By the end of this module learners will be able to understand the components, principle of operation and maintenance and repair of the two-stroke (C.I.) engine
Learning Outcomes	1. Explain the principle of operation of the two-stroke C.I. engine, the components and their functions and compare with that of the S.I. engine 2. Servicing, maintenance of two stroke cycle
Elements	1. Two stroke C.I. engine: principle of operation of cycle, engine design, components, functions Components of two stroke C.I. cycle: ports, scavenging pump, blower, piston 2. Maintenance: routine maintenance and repair
Learning Strategies	1. In groups, discuss the principle of operation of the two stroke- cycle, the components of the engine and their functions and relate it to S.I engine; make presentations 2. Practise maintenance of the two-stroke CI engine and troubleshoot faults
Assessment	1. Written or oral explanation of the principle of operation of the two-stroke cycle, the components and their functions and comparison with an S.I. engine 2. Observation of skills in maintenance and repair of two stroke C.I. engines

Mechanical Engineering: Automotive	
S4	**Module 3: Fuel Injection System (C.I.)**
Description	By the end of this module learners will be able to understand the principle, operation, components, functions and maintenance of C.I. fuel injection systems
Learning Outcomes	1. Describe the working principles and operation of different types of C.I. fuel systems 2. Identify and describe the functions of the components of C.I. fuel systems 3. Service C.I. fuel systems and rectify faults
Elements	1. Working principle and operation: Fuel ignition by heat generated when gas is compressed, fuel injected at peak compression Types: plunger (inline), rotary (distributor) 2. Components: fuel tanks, fuel filter, fuel pipes, fuel feed pump with primer, fuel injection pump and atomizer; functions of each 3. Fuel system servicing: routine service and repair of fuel tank, fuel lines, fuel pumps and atomizers; Troubleshooting common problems
Learning Strategies	1. In groups, discuss the working principles and operation of different types of fuel pumps and make presentations 2. In groups, discuss the functions of the components of fuel system and make presentations 3. Practise servicing fuel systems and rectifying faults
Assessment	1. Written or oral explanation working principles and operation of different types of fuel pump 2. Written or oral explanation the functions of the components of fuel systems 3. Observation of skills in servicing of fuel system and rectifying faults

Mechanical Engineering: Automotive	
S4	**Module 4: Alternator/Magneto**
Description	BBy the end of this module learners will be able to understand the purpose, working principle and components of the alternator and carry out maintenance and repairs
Learning Outcomes	1. Explain the purpose and working principle of the alternator and regulator 2. Explain components of alternator and their functions 3. Service the alternator and rectify faults
Elements	1. Purpose: provide power to charge battery and power vehicle's electrical system Working principle: convert mechanical energy into electrical; electromagnetic induction, voltage regulation 2. Components and functions of: field frame, armature, commutator, brushes, diode 3. Service: routine service and repair of brushes, diodes, bearing bushes, armature
Learning Strategies	1. Discuss in group the purpose and principle of an alternator and regulator and do presentations 2. In groups, discuss the components of an alternator and their functions and make presentations 3. Practise servicing the alternator and rectifying faults
Assessment	1. Written or oral explanation of the purpose and working principle of the alternator and regulator 2. Written or oral explanation of the components of alternator and their functions 3. Observation of the skills involved in servicing an alternator and rectifying faults

Mechanical Engineering: Automotive	
S4	**Module 5: Starter Motor**
Description	By the end of this module learners will be able to understand the principle and components of different types of electric starter used in a motor vehicle, service and rectify faults.
Learning Outcomes	1. Explain the principle and the types of electric starter 2. Explain the components of a starter motor and their functions 3. Service the starter and rectify faults
Elements	1. Principle: powerful electric motor provides initial impulse to turn engine over to start it Types: inertia starter drives, pre-engage starters 2. Components: armature, field winding, bushes, solenoids, pinion, driver, engaging lever; functions of each 3. Service: routine service and repair of bushes, solenoids, pinion, armature
Learning Strategies	1. Discuss in groups the purpose and principle of electric starters and do presentation 2. Discuss in groups the components of a starter and their functions and do presentation 3. Practise servicing the starter and rectifying faults
Assessment	1. Written or oral explanation the purpose and principle of electric starters 2. Written or oral explanation the components of starters and their functions 3. Observation of skills used in servicing and maintaining the starter and rectifying faults

Mechanical Engineering: Automotive	
S4	**Module 6: Lighting System**
Description	By the end of this module learners will be able to understand the lighting and wiring in automotives and to troubleshoot faults
Learning Outcomes	1. Explain purposes of lighting systems in motor vehicles 2. Explain the colour coding, wire sizes, symbols used in lighting systems 3. Service and maintain wiring system and troubleshoot problems
Elements	1. Purposes: headlights, packing light, direction signal light, backup light, interior light, tail light, indicator light, stoplight 2. Colour coding: brown, yellow, white, green, light green, blue, red and black Symbols: wiring, battery, capacitor, dimmer switch, fuses Cable sizes: reasons for using the right cable size 3. Servicing: checking for correct operation; troubleshooting: short circuit, power failure, bulb failure, wiring failure, blown fuses
Learning Strategies	1. Discuss in groups the purposes of the lighting system in vehicles and make presentation 2. In groups discuss the colour coding, cable sizes and symbols and do presentation 3. Practise servicing and maintenance of lighting systems and troubleshoot problems
Assessment	1. Written or oral explanation of various purposes of lighting system in vehicles 2. Written or oral explanation of the colour coding, wiring sizes and symbols 3. Observation of skills in servicing, maintenance and troubleshooting of problems in lighting systems

Mechanical Engineering: Automotive	
S4	**Module 7: Battery**
Description	BBy the end of this module learners will be able to understand the principle, operation, functions, types and construction of the battery and be able to carry out servicing, maintenance and repair
Learning Outcomes	1. Describe the principle of operation of the battery in vehicles, the key terms and their meanings 2. Understand different types of battery, their construction and their functioning 3. Servicing and maintenance of batteries and troubleshooting problems
Elements	1. Principle of operation: chemical action producing electrical energy; Terms: voltage, current, internal resistance, charging, overcharging, discharging, maintenance 2. Types of battery: lead acid battery, alkaline battery, zinc air battery Construction: battery cells, the battery plates, separator, electrolyte, vent plugs, battery box, terminals Functioning: chemical reactions taking place in each type to produce electrical energy 3. Practical maintenance and troubleshooting: testing (voltmeter, ammeter, hydrometer), charging, discharging
Learning Strategies	1. Group discussion of the principle of operation of a motor vehicle battery using correct terms and make presentation 2. Group work discussing the different types of battery, their construction and their functions and make presentations 3. Practise servicing and maintenance of the batteries and troubleshoot problems
Assessment	1. Written or oral explanation of the principle of operation of a motor vehicle battery 2. Written or oral explanation different types of battery, their construction and their functions 3. Observation of skills in servicing and maintenance of the batteries and in troubleshooting problems

Building Construction & Concrete Practice

Building Construction And Concrete Practice	
S1	**Module 1: Building Construction And Concrete Practice**
Description	By the end of this unit learners will understand key elements of building construction and concrete practice.
Learning Outcomes	1. Understand key elements of building construction and concrete practice. 2. Understand and practise routine health and safety measures. 3. Be able to construct: foundations, grade beams, columns, walls, slabs and roofs
Elements	1. Building construction: foundations, grade beams, columns, walls, slabs and roofs; Concrete practice: reinforcements, sand, cement, water and aggregates. 2. Health and Safety measures: clothing, boots, overalls, gloves, goggles, helmet, mask and aprons; first aid and safe working techniques. 3. Standard tools and materials required for construction of elements in 1.
Learning Strategies	1. In groups, discuss and describe the key elements of building construction and the materials of concrete practice; practise sketching foundations, grade beams, columns, slabs and roofs, explaining how the materials are used in each 2. Discuss and explain the safety measures used in construction of foundations, grade beams, columns, walls, slabs and roofs, make presentation in the class 3. Construct foundations, grade beams, columns, walls, slabs and roofs, observing all safety measures
Assessment	1. Written or oral explanation or sketches of foundations, grade beams, columns, walls, slabs and roofs. 2. Written or oral explanation of safety measures or observation of practice 3. Observation of the skills in making the products; evaluation of the quality of the products

Building Construction And Concrete Practice	
S1	**Module 2: Safety Rules And Regulations**
Description	By the end of this unit learners will understand safety rules and regulations and apply them accordingly in the learning practice.
Learning Outcomes	1. Understand safety rules and regulations and the need for each of them. 2. Demonstrate observation of safety rules and regulations in practice.
Elements	1. Safety Rules: Safe handling, application and storage of tools, workshop cleanliness; Regulations: Use of facilities, building standards. 2. Practical application of safety rules and regulations.
Learning Strategies	1. In groups, list and practise the application of safety rules and regulations; make a presentation describing, classifying and justifying the safety rules and regulations for handling hand tools. 2. Working in groups, practise using the hand tools, facilities, workshop with appropriate application of the safety rules and regulations.
Assessment	1. Written or oral explanation of correct application of safety rules and regulations. 2. Observation of skills in applying safety rules and regulations in using hand tools and wearing protective clothing; written evaluation of building standards.

Building Construction And Concrete Practice	
S1	**Module 3: Tools And Equipment**
Description	By the end of this unit learners will be able to understand tools and equipment, their groups, their uses, and will be able to apply them appropriately.
Learning Outcomes	1. Be able to name tools and equipment and explain their uses. 2. Demonstrate application of learning by using tools and equipment appropriately.
Elements	1. Tools and Equipment: brick trowel, spirit level, straight edge, builder's square, wheel-barrow, mortar tub, line, spade and hoe. 2. Application: gathering of the materials appropriately, selection of appropriate tools for different tasks, mix materials together using the right tools, transport mortar to the working area.
Learning Strategies	1. In groups, discuss tools, equipment and their uses; name and list the types of builders' tools and equipment and explain their uses to the class. 2. Working in groups, perform tasks and use the listed tools and equipment appropriately.
Assessment	1. Written or oral explanation listing tools and equipment and outlining the uses of each, giving reasons 2. Observe selection and appropriate use of tools and equipment.

Building Construction And Concrete Practice	
S1	**Module 4: Basic Building Materials**
Description	By the end of this unit learners will be able to understand the types of building materials, their properties, their uses and will be able to apply correct practice when using them.
Learning Outcomes	1. Understand the names, properties and purposes of building materials. 2. Demonstrate correct practice when using the materials.
Elements	1. Description:- cement, sand, bricks and water and properties of each Purposes:- cement: binding material; sand: bulk material; water: pliability; bricks: strength, rigidity 2. Correct methods applied to manual mortar mixing, cutting and laying bricks
Learning Strategies	1. Discuss the purposes of building materials, list the names and purposes of each and make presentation in the class 2. Working in groups, practise using the building materials appropriately
Assessment	1. Written or oral explanation of the names and purposes of using the building materials 2. Monitor the practice and evaluate the quality of the product.

Building Construction And Concrete Practice	
S1	**Module 5: Bonding And Its Rules**
Description	By the end of this unit learners will be able to identify types of bonds, materials and tools used and will be able to apply the methods in practice.
Learning Outcomes	1. Use different methods of bonding in practical situations 2. Select the correct types of bonds, materials and tools to be used. 3. Demonstrate the methods of bonding in practice.
Elements	1. Description: Bonding refers to the different arrangements of bricks to form a homogenised wall. Rules relating to brick size, amount of lap, avoiding brickbats, centre lines, alignment of vertical joints, stretchers in facings & hearting, header courses and raked joints. 2. Types: half bond (stretcher bond) and quarter bond (1 brick wall) Materials and tools: bricks, sand, cement, water, brick trowel, spirit level, builder's square and straight edge. 3. Methods: build half brick bond (1/2bk bond) and quarter brick bond (1/4bk bond).
Learning Strategies	1. Discuss and practice the arrangements of bonds and its rules in the class. 2. Discuss various types of bond; list the materials, tools used and methods; make a presentation. 3. Work in groups to carry out construction of the types of bonding according to its rules.
Assessment	1. Written or oral explanation of bonding arrangement and of the rules. 2. Written or oral explanation of different types of bonds, listing tools and materials and the methods applied. 3. Observation of the construction skills and evaluation of the quality of the product.

Building Construction And Concrete Practice	
S1	**Module 5: Bonding And Its Rules**
Description	By the end of this unit learners will be able to identify types of bonds, materials and tools used and will be able to apply the methods in practice.
Learning Outcomes	1. Use different methods of bonding in practical situations 2. Select the correct types of bonds, materials and tools to be used. 3. Demonstrate the methods of bonding in practice.
Elements	1. Description: Bonding refers to the different arrangements of bricks to form a homogenised wall. Rules relating to brick size, amount of lap, avoiding brickbats, centre lines, alignment of vertical joints, stretchers in facings & hearting, header courses and raked joints. 2. Types: half bond (stretcher bond) and quarter bond (1 brick wall) Materials and tools: bricks, sand, cement, water, brick trowel, spirit level, builder's square and straight edge. 3. Methods: build half brick bond (1/2bk bond) and quarter brick bond (1/4bk bond).
Learning Strategies	1. Discuss and practice the arrangements of bonds and its rules in the class. 2. Discuss various types of bond; list the materials, tools used and methods; make a presentation. 3. Work in groups to carry out construction of the types of bonding according to its rules.
Assessment	1. Written or oral explanation of bonding arrangement and of the rules. 2. Written or oral explanation of different types of bonds, listing tools and materials and the methods applied. 3. Observation of the construction skills and evaluation of the quality of the product.

Secondary 2

Building Construction And Concrete Practice	
S2	**Module 1: Tools and Equipment**
Description	By the end of this unit learners will understand the importance of tools and equipment, their types and how to use them safely.
Learning Outcomes	Deepening learning relating to tools and equipment in S1 Module 3: 1. Know and understand the importance of different tools and equipment for efficient and effective working on site and explain how to use them appropriately and safely. 2. Identify types and classification of tools and equipment and explain how their design is suited to their uses in laying and straightening, levelling and measuring, marking and cutting; finishing 3. Demonstrate safe and effective use of each tool and piece of equipment.
Elements	1. Importance of different tools and equipment (brick trowel, spirit level, straight edge, builder's square, wheel-barrow, mortar tub, line, spade and hoe) for: accuracy, speed, neatness and measurement Safety: personal safety, safety in relation to equipment and tools, construction of safe and secure products 2. Classification of tools according to use: laying and straightening, levelling and measuring, marking and cutting; finishing 3. Application: safe and effective methods of use of each tool and type of equipment
Learning Strategies	1. Discuss the importance of accuracy, speed, neatness and measurement on a building site and the way the right tools and equipment serve these purposes; name and sketch the builders' tools and equipment, highlighting risks and safe use 2. Discuss different types and classifications of tools and equipment, explaining how the key features make them suitable for laying and straightening, levelling and measuring, marking and cutting, finishing and make presentations 3. Working in groups, practise using the tools and equipment appropriately
Assessment	1. Written or oral explanation of understanding of the importance of accuracy, speed, neatness and accurate measurement, and explaining how different tools and equipment serve these purposes 2. Written or oral explanation of listing different types, classifications of tools and equipment and how these are used in laying and straightening, levelling and measuring, marking and cutting; finishing 3. Observation of safe and effective use of tools and equipment and evaluation of the quality of the work carried out

Building Construction And Concrete Practice	
S2	**Module 2: Production Of Building Materials**
Description	By the end of this unit learners will understand the production of building materials, their types, classification and uses.
Learning Outcomes	1. Understand the types of building materials and the processes of production for each 2. Be able to classify the types of building material and explain the uses of each 1. Demonstrate the methods of production of each building material
Elements	1. Understand the types of building materials and the processes of production for each 2. Be able to classify the types of building material and explain the uses of each 1. Demonstrate the methods of production of each building material
Learning Strategies	1. Types of building materials: bricks, tiles, blocks, sand and aggregate Production processes: brick making, tile making, block making, sand extraction, stone quarrying 2. Classification: building, bonding and binding materials 3. Methods: brick and block moulding, tile baking, harvesting sand and aggregate
Assessment	1. In groups, research and discuss the types of building materials and the processes involved in producing them 2. Research and discuss the purposes of different building materials, classify each according to its use for building, bonding or binding 3. Working as a group, carry out the production of bricks, blocks and tiles; if possible extract sand and stone; produce aggregate

Building Construction And Concrete Practice	
S2	**Module 3: Setting Out Building Layout Plans**
Description	By the end of this unit learners will be able to understand the measurements and the scales used in plans and to demonstrate the correct procedures of setting the plan on the ground.
Learning Outcomes	1. Understand and interpret working drawing plans and measurements shown on them; be able to draw plans; describe procedures used in the making accurate measurements on the ground 2. Understand and interpret the scales used in working drawing plans 3. Demonstrate the methods and procedures of setting the plan on the ground in practice
Elements	1. Procedures: Setting out, measurement, scaling, building plan confirmation 2. Scales: 1:10, 1:25, 1:50, 1:75, 1:100. 3. Methods: 3:4:5, use of builders square
Learning Strategies	1. Discuss and find out the types of building layout plan; research how plans are set out on the ground; make a presentation to explain; practise drawing plans 2. Discuss the scales used in drawing and make presentations to explain how to interpret them 3. Work in groups and carry out the process of setting out the building layout plans on the ground.
Assessment	1. Written or oral explanation of a) interpretation of a building layout plan b) various types of building plans c) procedures in setting the plan on the ground; evaluation of quality of plans drawn 2. Written or oral explanation of interpretation of scales used in working drawings 3. Observation of practice in setting out plans and evaluation of quality of the ground layout

Building Construction And Concrete Practice	
S2	**Module 4: Foundations {1}**
Description	By the end of this unit learners will understand the basic methods of constructing foundations.
Learning Outcomes	1. Understand and describe foundations and their types 2. Identify the materials used and their properties 3. Carry out methods of constructing foundations
Elements	1. Description: Foundation: the base on which walls and piers are built Types: strip foundation, pad foundation and step foundation 2. Materials used: concrete, stone, brick, hard-core and mortar; properties of each 3. Methods: practical site clearance, setting, excavation and concreting
Learning Strategies	1. Discuss and research foundations during site investigations; list and sketch types of foundations 2. Discuss and list materials used in construction of foundations, relating properties of materials to the requirements of effective foundations 3. Working in groups, carry out site clearance, setting, excavation and concreting
Assessment	1. Written or oral explanation of foundations and their types 2. Written or oral explanation of the selection of the materials used in different types of foundations and make presentations 3. Observation of the skills in conducting site clearance, setting, excavation, concreting and evaluation of the quality of work done.

Building Construction And Concrete Practice	
S2	**Module 5: Walls**
Description	By the end of this unit learners will understand the materials used in different kinds of walls, their properties and the methods of construction of each.
Learning Outcomes	1. Understand the purposes of walls and describe types of walls 2. Identify the materials used and explain how their properties are appropriate 3. Understand the standard thicknesses of walls 4. Carry out construction of each type of wall
Elements	1. Description: a wall is a structure that defines an area, carries a load, provides shelter and security Purposes: to support floors and roofs, enclose or divide space of building Types: Load bearing wall and non-load bearing wall. 2. Materials used: stones, aggregate, cement, bricks, blocks, reinforcement and wood; properties of each 3. Thicknesses: ½ brick wall, 1 brick, 1.1/2 brick, 2 brick & over 4. Methods: select the materials, prepare mortar, construction of ½ brick wall, 1 brick wall and 1½ brick wall
Learning Strategies	1. Discuss the purposes of walls, list various types of walls and make a presentation 2. Discuss and list materials used in the construction of walls, explaining how each material's properties make it suitable 3. Find out the standard thickness of walls and the factors to be considered in selecting the right thickness for different buildings and conditions; make a presentation 4. Work in groups and carry out / practise construction of each type of walls
Assessment	1. Written or oral explanation of a) the purposes of the walls to support floors and roofs; to enclose or partition spaces and to provide shelter or security and b) the different types of walls 2. Written or oral explanation of the main materials used in walls and their properties 3. Written or oral explanation of standard wall thicknesses 4. Observation of skills in constructing walls and evaluation of the quality of the product

Building Construction And Concrete Practice	
S2	**Module 6: Openings In Walls**
Description	By the end of this unit learners will be able to identify types of openings, the materials used and methods of creating openings in walls.
Learning Outcomes	1. Understand and identify the basic types of openings in walls 2. Understand the materials used 3. Demonstrate the methods of creating openings
Elements	1. Basic types of openings: description of door, window and ventilation openings 2. Materials applied: bricks, stones, mortar and block 3. Methods: jamb and reveal opening
Learning Strategies	1&2. Discuss and list the types of openings in walls; research the selection of appropriate materials used in creating openings; make a presentation 3. Working in groups, practise the construction methods for creating openings
Assessment	1. Written or oral explanation of types and purposes of openings in walls, such as door, window and ventilation openings 2. Written or oral explanation of selection of appropriate materials for creating openings 3. Observation of skills in constructing door, window and ventilation openings; evaluation of the quality of work

Building Construction And Concrete Practice	
S2	**Module 7: Lintels**
Description	By the end of this unit learners will be able to explain the purpose of lintels, the materials used to make them and the methods of construction.
Learning Outcomes	1. Describe a lintel and the purpose of a lintel 2. Identify the materials used for lintels and the properties of each 3. Demonstrate the methods of construction
Elements	1. Description: A lintel is horizontal member used for bridging over wall openings; purposes: bridging over openings to enable the construction of the wall to continue above the lintel 2. Materials: concrete, wood, metal, bricks and block; properties of each 3. Methods: pre-cast and cast in-situ
Learning Strategies	1&2. Working in groups, use a range of sources to find out about the use and construction of lintels, the materials used and their properties; make a presentation to the class 3. Construct lintels of different materials
Assessment	1. Written or oral explanation of the purpose of a lintel i.e. to bridge wall openings to support construction above 2. Written or oral explanation of the five main materials used in their construction and their properties 3. Observation of skills in production of both pre-cast and cast in-situ lintels. across wall openings; evaluation of the quality of work.

Building Construction And Concrete Practice	
S2	**Module 8: Decorative Panels**
Description	By the end of this unit learners will be able to select appropriate materials and construct decorative panels.
Learning Outcomes	1. Describe the purpose and identify some common types of decorative panels 2. Understand the materials used and explain how their properties make them suitable 3. Demonstrate the methods of construction
Elements	1. Description: attractive decorations on the wall surfaces; Types: single basket weave, single herring basket weave, double basket weave, diagonal 2. Materials: facing bricks, mortar and paints 3. Methods: herring methods and backed weave methods
Learning Strategies	1. On site visit, research some common types of decorative panels and the methods of construction; make a presentation 2. Working in groups or individually, list and select appropriate materials for making decorative panels; produce a report 3. Working in groups or individually, construct decorative panels of different types e.g. basket weave, single herring, double basket weave
Assessment	1. Written or oral explanation of the purpose and types of decorative panels e.g. single basket weave, single herring, diagonal, double basket weave 2. Written or oral list of building materials used for construction of decorative panels and description of their properties 3. Observation of skills in making the product and evaluation of the quality of the panels

Building Construction And Concrete Practice	
S2	**Module 9: Copings**
Description	By the end of this unit learners will understand how to construct copings.
Learning Outcomes	1. Understand and describe types of copings and their uses 2. Identify the materials used and their properties 3. Demonstrate the methods of construction
Elements	1. Description: protective construction on top of exposed wall Types: concrete coping, brick on edge, saddle back coping and stone coping 2. Materials used: stones, bricks, all in aggregate, mortar; properties of each 3. Methods: cast in-situ and brick on edge method.
Learning Strategies	1. Observe and discuss in the class how the copings are set and constructed 2. In groups, compare different types of copings, evaluate the most appropriate use for each, consider the best materials for different conditions; make a presentation 3. Work in groups to construct the different types of copings
Assessment	1. Written or oral explanation of the description, the types of copings and their uses 2. Written or oral explanation of the reasons for using materials in different conditions 3. Observation of skills in making the product and evaluation of the quality of the copings made

Secondary 3

Building Construction And Concrete Practice	
S3	**Module 1: Foundations {2}**
Description	By the end of this unit learners will be able to identify and construct the appropriate type of foundation for each type of soil.
Learning Outcomes	1. Understand and describe the types of soil on which foundations might be built and the properties of each soil type 2. Identify appropriate foundations for each type of soil and explain the reasons 3. Explain the procedure of foundation-making and the safety measures involved 4. Carry out steps required for concreting of foundations
Elements	1. Types of soil: clay, loam, hard soil, grave soil and black cotton soil 2. Types of foundations: pile, raft and step foundation 3. Safety and procedure: clothing, boots, overall, gloves, helmet and timbering of trenches 4. Method: manual soil test, hand tool excavation and manual concreting
Learning Strategies	1&2. Class discussion of types of soil, types of foundations and the need to select the right types of foundations for different soils; compare properties of the soil types, practise selecting the appropriate type of foundation for each and explaining the choice 3&4. In groups, practise timbering of trenches and observing safety measures, setting and constructing different types of foundations
Assessment	1. Written or oral explanation of the soil types and properties 2. Written or oral explanation of the types of foundations and their properties, which are appropriate for each soil type and reasons 3&4. Written or oral explanation or practical demonstration of application of safety measures and skills in foundation-making; evaluation of quality of foundations made

Building Construction And Concrete Practice	
S3	**Module 2: Drainage Systems {1}**
Description	By the end of this unit learners will be able to identify the types of drainage system and carry out practical laying out of drainage needed for a site.
Learning Outcomes	1. Understand the purpose and types of the drainage system and explain how each of them works 2. Understand the use and properties of the materials involved in construction and the methods used 3. Carry out trench excavation, provide concrete bases and lay pipes according to specified gradients and conduct drainage tests
Elements	1. Purpose: The drainage system is way of conveying the waste or foul waters through a pipe system up to the final area of treatment; Types: single and double drainage systems 2. Materials used: asbestos, fibre, PVC, cast-iron, cement pipes, chamber covers, appliance and fittings; properties of each 3. Procedures: setting, excavation, testing and backfilling Methods: manual excavation, concreting, laying of pipes, drainage tests
Learning Strategies	1. Working in groups, discuss the types and functions of drainage systems; make a presentation 2. Working in groups, select appropriate type of materials for drainage systems in different circumstances and construction methods, explaining reasons for choices 3. Working in groups, set pipe lines on the ground, excavate the trenches, cast concrete bases, lay pipes, build inspection chambers and conduct drainage tests
Assessment	1. Written or oral explanation of the types and functions of drainage system 2. Written or oral explanation of the reasons for choosing materials and construction methods 3. Observation of the skills of excavation, casting concrete bases, laying pipes, constructing inspection chambers and drainage testing; evaluation of the quality of the drainage work.

Building Construction And Concrete Practice	
S3	**Module 3: Cavity And Solid Walls**
Description	By the end of this unit learners will be able to understand the purposes of cavity and solid walls and the bonding used in construction.
Learning Outcomes	1. Understand the purposes and the differences between the two types of walls 2. Understand the types of bonding applicable in each type of wall 3. Construct cavity and solid walls, using appropriate bonding arrangements
Elements	1. Differences: a cavity wall is built in two leaves with a space / cavity between them while a solid wall is built without a space Purposes: heat insulation and sound control 2. Types of bonding applied: half and quarter bonds 3. Methods of construction: for cavity two leaves constructed with cavity in between, for solid wall one solid wall constructed
Learning Strategies	1. Working in groups, discuss and compare the structure and purpose of the two types of walls; make a presentation 2. In groups, discuss the different types of bonds and the reasons for using each; make a presentation 3. Working in groups, carry out the practice of building a cavity and a solid wall
Assessment	1. Written or oral explanation of the difference in the structure and purpose of the two types walls 2. Written or oral explanation of the types of bonds and the reasons for choosing each 3. Observation of the skills during constructing the walls, evaluation the quality of products (solid and cavity wall)

Building Construction And Concrete Practice	
S3	**Module 4: Bridging Over Openings**
Description	By the end of this unit learners will be able to understand the types and purposes of bridging, to calculate materials needed for the span of an opening, and to apply methods of construction.
Learning Outcomes	1. Understand the types of bridging, the purposes of bridging openings in walls and the materials used 2. Be able to measure the span to be bridged and calculate length or quantity of the bridging material 3. Be able to carry out various methods for bridging over openings
Elements	1. Types of openings: widows, doors and vent openings Types of bridging over openings: lintel, arch and beam Purposes: to close the opening and support the wall over it 2. Measurement: 1 to 2 metres or more depending on span of opening Materials: concrete, wood, steel, bricks and blocks 3. Methods: pre-cast and cast- in-situ.
Learning Strategies	1. In groups, discuss the purposes of bridging, the types of openings in the wall and materials used to bridge them; make a presentation in the class. 2. Practise measuring the span, selecting the materials and calculating the length or quantity of bridging material needed 3. Practise the various practical methods of bridging over openings using different materials
Assessment	1. Written or oral explanations of the types and purposes of openings, the purposes of bridging over openings and the materials used. 2. Observation of measurement skills, written or oral explanation of calculations of length or quantity. 3. Observation of the skills and evaluation of the product.

Building Construction And Concrete Practice	
S3	**Module 5: Rocks**
Description	By the end of this unit learners will understand the geological formation of rocks, methods of stone quarrying and the uses of quarried rocks for specific construction purposes.
Learning Outcomes	1. Understand and identify the origin of the three rock types and their properties 2. Understand the methods of quarrying 3. Identify and select the rocks for specific construction works
Elements	1. Description: rocks are natural building materials used for various types of building construction; Types of rocks: igneous, metamorphic and sedimentary and their properties 2. Process of quarrying: manual and mechanical methods and tools required 3. Uses: Building stone – strong, weather resistant blocks; Decorative building stone – strong, polished rock such as granite and marble; Aggregates – small pieces of rock used in concrete or asphalt; Cement manufacture – limestone or chalk with clay or sandstone Methods: collection and classification, matching properties to works specifications
Learning Strategies	1. Working in groups or individually, carry out a site investigation on the origin of rock types; make a presentation 2. In groups, research methods of quarrying the types of stones used in building and construction; produce a report on selecting an appropriate method for different rock types and situations 3. In groups or individually, practise classification of rocks and matching different types to their uses in building and construction
Assessment	1. Written or oral explanation of the origin of rock types and the properties as the most important material in construction. 2. Written or oral explanation of the methods of quarrying and the tools involved 3. Observation the skills in classification of rocks and selecting the appropriate stones for different uses in building and construction

Building Construction And Concrete Practice	
S3	**Module 6: Wall Finishes**
Description	By the end of this unit learners will be able to understand the range of wall finishes, the appropriateness of finishes for different internal and external walls surfaces and how to apply finishes.
Learning Outcomes	1. Understand the different types of wall finishes, their properties and the range of types and conditions of wall surfaces to which finishes can be applied 2. Identify appropriate materials for finishing different wall surfaces and the tools required to apply them 3. Carry out different methods for finishing wall surfaces
Elements	1. Types of finish: plaster, render, rough-casting, pointing / jointing, cladding Condition: assessment of types and quality of wall surfaces 2. Materials: stabiliser, plaster, cement, sand, slabs, water and coarse aggregate Tools: trowels, wooden/steel floats, spirit level, straight edge, jointers, and rough-cast machine 2. Methods: plastering, rendering, pointing/jointing, rough-casting and cladding
Learning Strategies	1. In groups, study and discuss types of wall finishes, the types and conditions of wall surfaces that require finishes and the properties of each finish 2. In groups or individually, select finishing materials for different wall surfaces and the tools used to apply them 3. Working in groups, carry out the methods of applying different wall finishes
Assessment	1. Written or oral explanation of the range of wall surfaces, the types of finishes that can be applied to them and the properties of different finishes 2. Written or oral evidence of understanding of the reasons for selecting a) different finishes b) appropriate finishes for different wall surfaces and c) the tools required for finishing 3. Observation of the skills in practising the methods used for finishing wall surfaces and evaluation the quality of the product

Building Construction And Concrete Practice	
S3	**Module 7: Matrix / Cement And Lime**
Description	By the end of this unit learners will understand the geological formation of rocks, methods of stone quarrying and the uses of quarried rocks for specific construction purposes.
Learning Outcomes	1. Understand the chemical reaction between cement / lime and water 2. Understand the ratios of cement / lime to sand for different purposes 3. Mix cement / lime and sand with water in the correct ratios to produce the chemical reaction safely
Elements	1. Description: cement / matrix is a binding agent in mortar and concrete; Chemical reaction: produces heat and can cause scaling or breaking of the skin of unprotected hands. 2. Proportion: for mortar 1:3 or 1:4 or for concrete 1:2:4 or 1:3:6 and for lime is 1:2. 3. Methods: mix the cement/lime and add water to conform the reaction; Safety requirements: gloves, overalls, helmet and boots.
Learning Strategies	1&2. In groups, discuss and experience the chemical reaction of cement / lime and water, using different mixing ratios in the workshop, discuss safety measures; make a presentation 3. Working in groups, practise the methods of mixing the cement / lime, sand and water
Assessment	1. Written or oral explanation of the chemical reaction between cement, lime and water and the safety measures that should be taken 2. Written or oral explanation of appropriate mixes of cement / lime and sand for different purposes 3. Observation of skills in mixing of the materials, and assessment of the quality of the products

Building Construction And Concrete Practice	
S3	**Module 8: Concrete**
Description	By the end of this unit learners will understand the types of materials used in concrete, identify formwork and demonstrate the methods of concreting.
Learning Outcomes	1. Description: concrete is formed from a mixture of materials that binds building materials and sets hard when mixed with water, giving strength and durability to different structures Types of concrete: structural concrete, masonry concrete and insulating concrete Materials: cement, sand, coarse and fine aggregate, water 2. Methods: manual mixing and use of mechanical concrete mixer; use of formwork
Elements	1. In groups, explore the importance of different types of concrete, their uses in building and construction and the standard materials used in different types of concrete production; make a presentation 2. Working in groups, practice the methods involved in production of different types of concrete using manual methods or mechanical concrete mixers
Learning Strategies	1. In groups, explore the importance of different types of concrete, their uses in building and construction and the standard materials used in different types of concrete production; make a presentation 2. Working in groups, practice the methods involved in production of different types of concrete using manual methods or mechanical concrete mixers
Assessment	1. Written or oral explanation of the description of concrete, the types of concrete, the importance of the different types of concrete in building and construction and the materials used to make them 2. Observation of the skills in practicing the methods of producing various types of concrete and concrete structures: evaluation of the quality of products

Building Construction And Concrete Practice	
S3	**Module 9: Scaffolding**
Description	By the end of this unit learners will understand the purposes, types and methods of constructing various types of scaffolding.
Learning Outcomes	1. Describe the types of scaffolding, its uses and the materials used for scaffolding 2. Apply methods of constructing various types of scaffolding
Elements	1. Description and use: scaffolds are temporary structures used to support workers and materials above the ground Types of scaffolding: putlog and independent scaffolds Materials: timber, metal and bamboos 2. Methods of construction: assembling/fitting and use of nails / bolted brackets
Learning Strategies	1. In groups, research the types, materials, properties, function and safe use of scaffolding and make a presentation in the class 2. Working in groups, practise constructing a range of scaffolds of different types and materials
Assessment	1. Written or oral explanation of types, materials, functions, properties and safe use of scaffolding 2. Observation of skills in carrying out the methods of construction of different types of scaffolds and evaluation of the quality of products

Building Construction And Concrete Practice	
S3	**Module 10: Shores**
Description	By the end of this unit learners will understand the types and purposes of shores, and identify where and how shores are used in building and construction.
Learning Outcomes	1. Describe the purposes of shores, the circumstances in which they are needed and the materials used 2. Understand the types of shores and how they are positioned to achieve their purpose 3. Demonstrate the methods of construction and fitting of shores
Elements	1. Description: shore is a term applied to a brace component used to support a structure and prevent any movement during other operations adjacent to that structure Materials: timber and steel 2. Types of shores: racking shore, flying shore and dead shore and positioning of each 3. Methods: manual fitting and use of nails.
Learning Strategies	1. In groups, research the principles of shores, their purposes in different situations and the materials used for the construction of shores; make a presentation 2. Discuss and name the types of shores, their applications and the positioning of each; produce a report 3. Construct and fit various types of shores
Assessment	1. Written or oral explanation of the principles of shores, their purposes in different situations and the materials used to make them 2. Written or oral explanation of the types of shores and how they are positioned to be effective. 3. Observe the skills used in constructing and fitting shores; evaluation of the quality of work in construction and fitting of shores in various situations of wall defects.

Building Construction And Concrete Practice	
S3	**Module 11: Block Work**
Description	By the end of this unit learners will understand the materials and equipment applied in moulding blocks, standard measurements, types and sizes and will be able to apply methods in practice.
Learning Outcomes	1. Describe the uses and types of blocks and understand the materials used to make them 2. Classify tools and equipment needed to make blocks and explain how they are used 3. Understand the standard measurements of blocks 4. Carry out the methods of moulding blocks.
Elements	1. Description: blocks are building materials use for walling Types of block: solid and hollow blocks Materials: clay, cement mortar, concrete, saw-dust and ash-cement 2. Tools and equipment: shovels, trowels, hoes, wheelbarrow and head pan 3. Standard measurements: 450mm x 100mm x 250mm; 450mm x 125mm x 225mm; 450mm x 150mm x 225mm; 450mm x 225mm x 225mm 4. Methods: manual and mechanical moulding
Learning Strategies	1. In groups, discuss the uses of blocks, the types and the materials used for making them; make a presentation 2. In groups, find out which tools are needed for making blocks and how they are used; make a presentation 3. Find out and produce a report on the measurements of the standard sizes of blocks 4. Working in groups, practice the methods of block making
Assessment	1. Written or oral explanation of the uses and types of blocks and the materials they are made of 2. Written or oral explanation of the tools needed to make blocks and how they are used 3. Written or oral explanation of the different standard sizes of blocks 4. Observation the skills used in making different types of blocks; evaluation of the quality of the blocks produced

Building Construction And Concrete Practice	
S3	**Module 12: Staircases**
Description	By the end of this unit learners will understand the materials and equipment applied in moulding blocks, standard measurements, types and sizes and will be able to apply methods in practice.
Learning Outcomes	1. Describe the purpose of a staircase and identify the different types 2. Understand the functional requirements of a staircase and the materials used 3. Demonstrate the ability to construct staircases
Elements	1. Description: staircase is a means of access from one floor level to another; Types of staircases: straight flight, quarter turn, half turn, open well and geometric. 2. Functional requirements: constructed of sound materials using good workmanship, easy to access, risers all at same height. Materials used: concrete, steel, bricks/blocks, beams, timber and stone. 3. Methods of construction: manual methods according to the type and use of staircase
Learning Strategies	1. In groups, discuss the purpose and types of staircases; produce a report 2. In groups, research and discuss the functional requirements of a staircase; discus the materials used; make a presentation in the class 3. In groups or individually, carry out construction of various types of staircase
Assessment	1. Written or oral explanation of a staircase as means of access from one level to another and the types of staircase 2. Written or oral explanation of the functional requirements of a staircase and the range of materials used for construction 3. Observation of the skills in constructing different types of staircases; evaluation of the quality of the work.

Secondary 4

Building Construction And Concrete Practice	
S4	**Module 1: Arches**
Description	By the end of this unit learners will be able to demonstrate methods of construction of each type of arch in appropriate situations.
Learning Outcomes	1. Understand the purpose of arches and the characteristics of the different types of arches 2. Understand the materials used in arches and their functional requirements 3. Understand methods of construction and demonstrate ability to construct each type in appropriate situations
Elements	1. Description: arches are used to bridge openings in walls Types: semi-circular, equilateral, drop, lancet, gothic, soldier 2. Materials: bricks, steel, stones, concrete blocks Functional requirement: to bridge an opening; to support the structure above; decorative functions as appropriate 3. Methods: Practical construction by use of an arch centre or turning piece and geometrical construction methods
Learning Strategies	1. In groups, discuss and describe the purposes and type of arch and produce a report 2. Discuss the materials used in constructing arches and their functional requirements; make presentations 3. Construct various types of arches using appropriate methods
Assessment	1. Written or oral explanation of the purposes and types of arches 2. Written or oral explanation of the materials used for arch construction and their functional requirements 3. Observation of the skills used in constructing various types of arches, and evaluation of the quality of work

Building Construction And Concrete Practice	
S4	**Module 2: Drainage Systems {2}**
Description	By the end of this unit learners will be able to lay out drain pipes, test to identify blockages and leaks and ensure correct flow.
Learning Outcomes	1. Understand methods and types of drainage systems as per the previous lesson on drainage system 2. Understand the need for testing and explain the testing methods 3. Carry out the testing methods selected for the drainage system and address any faults detected
Elements	1. Previous lessons: definitions of the two systems, setting, excavation of drainage work; laying methods: uniform gradient and provision of inspection chambers 2. Testing methods: torch, mirror and ball tests for obstruction; smoke and hydraulic tests for leakage 3. Practical application of different tests listed above and correcting faults identified
Learning Strategies	1. In groups, discuss the types of drainage systems and methods involved, from the previous lesson in senior three and make presentations 2. Discuss drainage system tests methods, types of tests and make presentations 3. Conduct the different drainage pipe tests and correct problems
Assessment	1. Written or oral discussion and explanation of types of drainage system as per previous lessons from senior three 2. Written or oral explanation of the various methods of testing of drain pipes 3. Observation of skills used in different methods of testing and in correcting obstructions or leaks found; evaluation of the quality of the testing and actions to correct flow

Building Construction And Concrete Practice	
S4	**Module 3: Fireplaces**
Description	By the end of this unit learners will understand the types and materials used, understand and apply the methods of construction of fireplaces.
Learning Outcomes	1. Understand the purpose and description of fireplaces 2. Understand the types of fireplaces, and the materials used 3. Demonstrate the methods of construction
Elements	1. Description and purpose: a fireplace is an architectural structure made of brick, stone or metal designed to contain fire, to provide heating, to cook and for relaxation 2. Types of fireplace: masonry, metal, electric and direct vent fireplaces Materials: bricks, stones, metal and concrete. 3. Methods of construction: setting and excavation, casting and building the chimney-breasts and the flues.
Learning Strategies	1. Discuss the purposes and descriptions of fire places; produce a report 2. Research the various types of fireplaces, listing the materials used and the reasons for choosing them; make presentations 3. In groups or individually, perform tasks in constructing fireplaces using different methods.
Assessment	1. Written or oral description of fireplaces and their purposes 2. Written or oral explanation of various types of fireplaces and the materials used in their construction, giving reasons 3. Observation of skills in constructing fireplaces and evaluation of the quality of the work

Building Construction And Concrete Practice	
S4	**Module 4: Floors**
Description	By the end of this unit learners will be able to demonstrate the methods of constructing various types of floors.
Learning Outcomes	1. Understand the importance of floors, the types of floors, tools and materials used in laying floors 2. Identify and outline the techniques of using the tools and equipment involved in making floors 3. Be able to set and construct various types of floors
Elements	1. Description: floor is a horizontal structure which carries imposed and live loads in buildings and divides a building into storeys Types of floor: basement floor, ground floor and upper floor Materials used for construction: concrete, metal, timber and hollow blocks Tools and equipment: concrete mixture, spade, vibrator, loader, straight edge, steel and wooden floats 2. Methods of construction: compaction, setting bays, levelling, and concreting 3. Practical application of methods
Learning Strategies	1. Discuss in groups the importance of floors, floor types, tools and materials used in construction. 2. Explain and find out the techniques involved in using the tools and equipment involved in construction of various types of floors 3. Work in groups to construct different types of floors
Assessment	1. Written or oral explanation of the importance of floors, floor types and materials used in construction 2. Written or oral explanation of the techniques of use of the tools and equipment in construction of floors 3. Observation of practical skills in constructing floors and evaluation of the quality of work

Building Construction And Concrete Practice	
S4	**Module 5: Retaining Walls**
Description	By the end of this unit learners will be able to construct different types of retaining walls.
Learning Outcomes	1. Understand and describe the purposes and types of retaining walls 2. Understand and identify the materials used and the reasons for their use 3. Demonstrate practical methods of construction
Elements	1. Description: retaining wall is a structure designed and constructed to resist the lateral pressure of soil when there is desired change in elevation Purposes: to retain soil, to maintain landscape and to resist water Types: mass and cantilever {reinforced} retaining walls 2. Materials: stones, cement, blocks, sand, water, bricks and reasons for their use 3. Methods of construction: to set out the plan, excavate soil, cast foundations, build up the wall
Learning Strategies	1. Discuss the features, purposes and types of retaining walls; make presentations 2. Discuss and list the materials used in range of retaining walls, relating their properties to their uses 3. Working in groups, construct different types of retaining walls using different types of materials
Assessment	1. Written or oral explanation of the purposes and types of retaining walls 2. Written or oral explanation of the various materials used, giving reasons 3. Observation of skills in building the retaining walls; evaluation of the quality of the work

Building Construction And Concrete Practice	
S4	**Module 6: Fabricated Building Structures**
Description	By the end of this unit learners will understand the need for and uses of fabricated building structures and will be able to construct them.
Learning Outcomes	1. Understand the purposes and description of fabricated building structures 2. Identify types of materials used in fabricated building structures, giving reasons for each 3. Demonstrate the methods of construction of fabricated structures
Elements	1. Description: a fabricated structure is a building normally made of metal structures produced by cutting, bending and assembling processes Purposes: to control cost, manage timelines, simple to assemble, fire resistant 2. Types of materials used: steel stanchions, sheet metal, fittings and concrete, formwork, shuttering; properties of each and reasons for use 3. Methods of construction: setting the foundation, excavation, casting, bolting steel stanchions, applying wall coverings.
Learning Strategies	1. In groups, discuss the purposes and outline the reasons for constructing fabricated building structures; make a presentation 2. In groups, discuss the types of materials and formwork applied during construction, giving the reasons for using each material; present a report 3. Working in groups, construct fabricated building structures assembling all components correctly
Assessment	1. Written or oral description of fabricated buildings and of their purposes 2. Written or oral explanation of the types of material used, giving reasons 3. Observation of skills in assembling the structure and evaluate the quality of the product.

Building Construction And Concrete Practice	
S4	**Module 7: Landscape**
Description	By the end of this unit learners will be able to design and carry out landscaping.
Learning Outcomes	1. Understand the purposes of landscaping 2. Understand and describe the processes involved in landscape design, the methods and materials used in practice in landscaping 3. Demonstrate practical methods of landscaping
Elements	1. Purposes: to improve appearance of an area of land, by changing the design and layout of the land and by planting trees, flowers and other plants. 2. Design plans and drawings, measurement, calculation of quantities of materials. Materials: reconstructed concrete slabs, stones, soil, clay, tiles, drain pipes, sand and cement, plants, grass Methods: setting, excavating, laying materials, alignments, finishing 3. Practical application of these techniques
Learning Strategies	1. In groups, research the purposes of landscaping; make a presentation 2. In groups, discuss the processes involved in landscape design, the materials used and the methods of landscaping; make presentations 3. In groups, practise carrying out landscaping using various methods
Assessment	1. Written or oral explanation of the purposes of landscaping 2. Written or oral explanation of the processes involved in landscape design, the materials required and the methods of landscaping. 3. Observation of practical skills in drawing landscape plans and construction a landscape; evaluation of the quality of landscape produced

Building Construction And Concrete Practice	
S4	**Module 8: Wood Wall Structures**
Description	By the end of this unit learners will be able to design and construct wood walls.
Learning Outcomes	1. Understand the description and types of the wood wall structures 2. Understand the materials used and their functional requirements 3. Demonstrate appropriate skills in methods of construction
Elements	1. Description: a wood wall is solid wall constructed of wood Types: platform frame and balloon frame 2. Materials used: solid post timber, soft wood, wood blocks and fittings Functional requirements: durability, thermal insulation, sound insulation, weather resistance, strength and stability 3. Methods of construction: post and beam, balloon and platform framing
Learning Strategies	1. In groups, discuss and describe wooden wall structures and their types; make presentations 2. Outline the materials used in wood wall structures and their functional requirements; present conclusions 3. Working in groups, design and construct different the two types of wood wall structures
Assessment	1. Written or oral description of wood wall structures and the types; make presentations 2. Written or oral explanation of the materials used for construction of wood wall structures and their functional requirements 3. Observe the skills used in design and construction; evaluation of the quality of the work

Building Construction And Concrete Practice	
S4	**Module 9: Drawing Software**
Description	By the end of this unit learners will be able to use appropriate software for design.
Learning Outcomes	1. Understand and describe types of drawing software 2. Understand the purposes and advantages of computer aided design and the techniques for using the software 3. Demonstrate application of methods of use of design software
Elements	1. Description: Drawing Software - computer programs for drawing structures and creating designs without any mechanical equipment 2. Use of the software: architectural view point, architectural description language and architectural framework Purposes of drafting: to produce precise 2 dimension{2D} and 3 dimension{3D}drawings, to guide systems of construction and maintenance, to aid system planning, costing and evaluation, to document architectural knowledge beyond the scope of an individual project 3. Methods of application: use of different computer software, AutoCAD, Archie CAD, others as software develops
Learning Strategies	1. In groups, discuss and describe types of drawing software; present a report 2. In groups, explore the purposes of computer-aided design and drafting and the basics of use of software; make presentations in the class 3. Individually practise the basics of drafting using computers and installed software
Assessment	1. Written or oral explanation of the use of software for drawing structures and creating designs and of different types of software 2. Written or oral explanation that the purpose of the software is drafting to produce precise 2 dimensional, 3 dimensional drawings and to guide systems of construction. 3. Observation of the exercise of drafting; evaluation of the drawings produced

Building Construction And Concrete Practice	
S4	**Module 10: Calculations, Estimates and Bills of Quantity**
Description	By the end of this unit learners will be able to make estimates, calculate quantities and make bills of quantity.
Learning Outcomes	1. Understand the meaning of and the need for estimates and calculations of relating to the areas of buildings 2. Understand the processes involved in making appropriate estimates and calculations of quantities; be able to make accurate calculations and estimates 3. Understand and practise the preparation of a bill of quantities [BoQ].
Elements	1. Description: estimating involves approximate calculation of the costs of materials and labour for building a structure; calculations of quantities involves working out how much of each material is needed; estimates and calculations provide the project manager with information about the total cost of the structure 2. Calculations of quantities of each material and of labour for each task; produce estimates. 3. Methods for calculating and estimating: the square meter method and the cubic meter method Bill of quantities: total area of building plans and its overall cost of materials
Learning Strategies	1. Explain the meaning of estimates and calculations and the need for producing estimates and calculations for building projects; produce a report 2. In groups, research and discuss methods of calculation and estimation and apply these producing appropriate estimates and calculations of the quantities for different projects; make a presentation 3. Individually, practise calculating and preparing a bill of quantities for a single 4 x 4 room
Assessment	1. Written or oral explanation of the meaning of estimates and calculations and the need for producing them when involved in a building project 2. Written or oral explanation of the processes involved in producing calculations and estimates and evaluation of the practical application of the skills in production of estimates and calculations for building projects 3. Observation of the practical skills involved in producing a bill of quantity; evaluation of the quality of the BoQ produced

Building Construction And Concrete Practice	
S4	**Module 11: Roofs**
Description	By the end of this unit learners will be able to identify the type of roof needed for a building and apply the appropriate methods of construction.
Learning Outcomes	1. Understand the purpose of roofing and identify different types of roofs and groups 2. Understand the materials used and their properties 3. Demonstrate the methods of construction
Elements	1. Purposes: to gives protection from weather and enclose the space above the walls Types of roof: lean, hip roofs and gable, group, flat and pitched 2. Materials: timber, corrugated iron sheets, tiles, nails, band irons, wind brackets and grass; properties of each 3. Methods of construction: setting span and rise for rafters, fixing struts, wall-tie and other roof components
Learning Strategies	1. In groups, discuss the purpose and types of roofs; make a presentation 2. Explain the materials used to construct roofs and how their properties make them suitable for roofing; prepare presentation 3. Working in groups, follow appropriate methods to construct different types of roofs
Assessment	1. Written or oral explanation of the purpose of roofs and the different types of roof 2. Written or oral explanation of the materials used for roofing and their properties 3. Observation of the skills used in constructing different types of roofs and evaluation of the quality of the products

Carpentry and Joinery

Carpentry and Joinery	
S1	**Module 1: Important Principles of Carpentry and Joinery**
Description	By the end of this module learners will understand the key principles of carpentry and joinery.
Learning Outcomes	1. Define the terms carpentry and joinery, identify the types of wood (timber) and the types of manufactured boards and understand their properties 2. Explain how the properties of different woods and boards make them suitable for particular uses and select accordingly
Elements	1. Definitions: Carpentry constructional jobs: roofing and ceiling, formwork, timbering trenches, stairs, partitions Joinery: furniture, beds, cupboards, chairs, desks flash doors and windows Wood types: mahogany, teak, pine, mango and others important in different localities Manufactured boards: laminated boards, shipboards, blackboard, block-board, veneer or ply woods 2. Properties: softwood, hardwood, colour, grain, strength, flexibility Select and use woods and boards appropriately for jobs listed in 1 and 2 above
Learning Strategies	1. Discuss the important terms of carpentry and joinery work: cutting, shaping, fastening wood to produce an item Discuss and understand the work of carpentry and joinery. • Carpentry (construction): roofing and ceiling, formwork, timbering, trenches partitions and staircase • Joinery (furniture): Beds, cupboards, chairs, desks, doors, windows etc. Make a presentation to explain 2. Investigate carpentry and joinery materials: timbers and manufactured boards and their properties; report conclusions to the class
Assessment	1. Written or oral explanation of the important terms of carpentry and joinery and of the different work involved in each branch 2. Written or oral explanation or practical demonstration of the ability to select appropriate wood and manufactured boards for use in carpentry and joinery work

Carpentry and Joinery	
S1	**Module 2: Workshop Safety Rules**
Description	By the end of this module learners will be able to comply with safety rules to avoid accidents in the workshop
Learning Outcomes	1. Outline safety rules for avoiding accidents in the workshop and understand the reasons for them 2. Understand and put into practice safe storage of hand tools, materials, use of protective clothing 3. Arrange the workshop in order to be clean, neat and safe
Elements	1. Safety rules relating to alertness to risk, dress, cleanliness, tidiness, intoxication, removing protruding nails, use and storage of tools. 2. Hand tools: tapes, rules, knives, gauges, squares, saws, chisels, planes, hammers, punches, vices, cramps, drills, bradawls, stones, screwdrivers Materials: timber, boards, fixings, glues Protective clothing: overalls, shoes, goggles 3. Listening carefully and practicing proper keeping of hand tools, materials, clothing plus benches, and other workshop equipment in order to avoid unnecessary accident or injury and damage to tools and equipment at the workshop.
Learning Strategies	1. Discuss the importance of safety rules and the risks and explain to the class how to stay safe in the workshop 2. Practise safe storage of hand tools listed in 2 above Practise safe storage of woodwork materials Use protective clothing appropriately 3. Practise organization and cleaning of the workshop to ensure safety
Assessment	1. Written or oral explanation of the safety rules, the reasons for them and how to put them into practice. 2. Practical demonstration or written or oral explanation of safe storage of tools and materials and use of protective clothing 3. Practical demonstration or written or oral explanation of safe arrangement and cleaning of the workshop

Carpentry and Joinery	
S1	**Module 3: Hand Tools**
Description	By the end of this module learners will be able to use competently a range of hand tools
Learning Outcomes	1. Name and classify the types of hand tools 2. Explain the uses of the different hand tools 3. Apply learning by using hand tools appropriately in practical work
Elements	1&2. Hand tool classifications and names: • Measuring tools: steel tapes, folding rules, and steel rules. • marking tools: Pencils, chalk lines, marking knife, marking gauge, cutting gauge, and mortise gauge, • Testing tools: spirit level, plumb needle, try square and MITRE square. • Cutting tools: saws: cross cut saw, rip saw, panel saw and tenon saw, and specials saws: bow saw, key hole-saw, compass saw, fret saw, and hack saw. • Parting tools: chisels planers. • Finishing tools: scrapers, glass paper and sand paper. • Driving tools: Hammers, mallets, punch, and screw rivers. • Holding tools: Bench vice, sash cramps, G cramps, holdfast, miter cramps. • Drilling tools: hand drills, gimlet ratchet brace, and bradawl. • Sharpening tool: Oil stones, grinders, files, and honing gauge. Screwdrivers 3. Practical use of each of the tools listed above
Learning Strategies	1. Practise naming and grouping hand tools into correct categories. 2. Research and practise using each of the hand tools correctly 3. Perform tasks requiring use of a range of hand tools
Assessment	1. Written or oral explanation or practical demonstration of the ability to name and group tools correctly 2. Practical demonstration (written or oral explanation) of the ability to use each tool correctly 3. Observation of skills in using each hand tool and / or evaluation of the quality of the product made.

Carpentry and Joinery	
S1	**Module 4: Timber Trees**
Description	By the end of this module learners will be able to identify a range of types of timber trees grown in different countries and understand the classes, uses and values of their wood.
Learning Outcomes	1. Identify a range of types of timber trees grown in different countries 2. Identify the types of timber these trees provide and their uses; understand their classification as first-class and valuable wood
Elements	1. Types of timber grown in different countries: • America - mahogany, pine, fir and various hard and softwood • India: Neem, Ilmi, Teak, Ebony, Mango, and various soft and hard wood • South Sudan: mahogany, teak, and other soft and hard woods • West and Central Africa: Classical and valuable wood, teak and mahogany plus hard and soft woods • United Kingdom: Types of soft and some hard woods (mostly pine) • Classical and valuable (first class) wood: teak, mahogany, and pine all around the world classify as first class wood 2. Uses of each type of timber
Learning Strategies	1. In groups, research types of timber and countries of origin and produce a report or presentation 2. In groups, using a range of sources, find out the types of timber the trees produce, their uses and their classification as first class or otherwise and present findings
Assessment	1. Written or oral explanation of the types of timber trees grown in different countries. 2. Written or oral explanation of the types of timber these trees provide, their uses and their classification as first-class and valuable wood

Carpentry and Joinery	
S1	**Module 5: Joints**
Description	By the end of this module learners will be able to perform the basic practice of making various types of joints.
Learning Outcomes	1. Understand the principles and practice of cutting and ripping of wood 2. Identify the principles of planing wood square 3. Describe the different types of joints 4. Construction of various types of joints
Elements	1. Cutting and ripping: Cutting: Measure, mark using try square, pencils and cross-cut saw (for cutting across the grain) Ripping: Measure, mark using a marking gauge and rip saw (for ripping along the grain) 2. Planing: Order: plane first face, then first edge, gauge to size, plane second face, plane second edge 3&4. Joints: butt, lapp, housing, halving, bridle, mortise and tenon, dovetail
Learning Strategies	1. Observe demonstrations of cutting and ripping wood to size and practise cutting and ripping 2. Observe demonstration of planning wood square, in groups practise the steps of planing wood to size 3. In groups find out about the various types of joints and make presentation to class 4. Practise and demonstrate making various types of joints
Assessment	1. Written or oral explanation of the cutting or ripping of wood 2. Written or oral explanation of the steps of planing wood square 3. Written or oral explain the various type of joints 4. Observe individuals making various types of joints and evaluate quality of products

Carpentry and Joinery	
S1	**Module 5: Joints**
Description	By the end of this module learners will be able to perform the basic practice of making various types of joints.
Learning Outcomes	1. Understand the principles and practice of cutting and ripping of wood 2. Identify the principles of planing wood square 3. Describe the different types of joints 4. Construction of various types of joints
Elements	1. Cutting and ripping: Cutting: Measure, mark using try square, pencils and cross-cut saw (for cutting across the grain) Ripping: Measure, mark using a marking gauge and rip saw (for ripping along the grain) 2. Planing: Order: plane first face, then first edge, gauge to size, plane second face, plane second edge 3&4. Joints: butt, lapp, housing, halving, bridle, mortise and tenon, dovetail
Learning Strategies	1. Observe demonstrations of cutting and ripping wood to size and practise cutting and ripping 2. Observe demonstration of planning wood square, in groups practise the steps of planing wood to size 3. In groups find out about the various types of joints and make presentation to class 4. Practise and demonstrate making various types of joints
Assessment	1. Written or oral explanation of the cutting or ripping of wood 2. Written or oral explanation of the steps of planing wood square 3. Written or oral explain the various type of joints 4. Observe individuals making various types of joints and evaluate quality of products

Year 2

Carpentry and Joinery	
S2	**Module 1: Timber Tree Growth**
Description	By the end of this module learners will be able to understand the structure of timber trees, the process of growing them and their uses.
Learning Outcomes	1. Understand the structure of timber trees 2. Understand the processes involved in growing timber trees 3. Know the uses of timber trees
Elements	1. Structure of the timber tree: crown, trunk, root system, branches and leaves. 2. Nursery bed, transplanting, weeding, pruning, marking, fire lines, felling. 3. Uses of timber tree: firewood, medicine, food, shelters, building, furniture, conservation of the environment.
Learning Strategies	1. Using a range of sources, identify the common structural features of timber trees and find out how each structure is named. Present a report of findings. 2. Role-play each of the steps in the process of growing timber trees. (Practical experience when possible). Document the steps from germination of seeds and caring for young seedlings through to harvest. 3. Research the uses of timber trees and present a report
Assessment	1. Written or oral explanation of the structure of timber trees 2. Observation of individuals in role-play or practical tree planting / other stages. Written or oral explanation of understanding of the processes involved in growing trees. 3. Written or oral explanation of the uses of timber trees.

Carpentry and Joinery	
S2	**Module 2: Hardwood and Softwood Timber**
Description	By the end of this module learners will be able to distinguish the two types of wood and explain their uses.
Learning Outcomes	1. Distinguish the types of wood 2. Understand the uses of each type of wood
Elements	1. Hardwood: camphor, mvule, teak, oak, mahogany and others relevant to the region Softwood: pine, cypress, leddor, podo and others relevant to the region 2. Uses of hardwoods: furniture, cabinet making, construction work (roofing, bridging and formwork, walling, ceiling board), arts and crafts Uses of softwoods: furniture, manufacturing of paper, firewood, construction work (roofing, formwork, walling, ceiling board), arts and crafts
Learning Strategies	1. In groups, research, document and report on the differences between the two types of wood: hardwood and softwood 2. Find out about the uses of different types of hard and softwood and match the uses to the properties of each; make a presentation to explain
Assessment	1. Written or oral explanation of the differences between hardwood and softwood and the types of each that are commonly used in South Sudan and locally 2. Written or oral evidence of understanding of the properties of different hard and softwoods and how these relate to the uses of each

Carpentry and Joinery	
S2	**Module 3: Conversion of Timbers**
Description	By the end of this module learners will understand the tools and equipment used in the process of conversion.
Learning Outcomes	1. Define the terms associated with conversion and describe methods of conversion 2. Understand the tools and equipment required for the process of conversion and the use of each tool 3. Demonstrate practical skills in converting logs
Elements	1. Terms: Felling, cutting, splitting Methods: Through and through, back, and quarter sawing 2. Saws: Circular, band, gang, power, hand and bow Practice: Measuring, marking, splitting, sizing
Learning Strategies	1. In groups or pairs, find out about the terms associated with conversion and the methods of conversion; feed back to the class 2. Research the tools and equipment required, match them with the methods of conversion and report on findings 3. Practice skills in converting logs into useable timber
Assessment	1. Written or oral explanation of terms and methods of conversions 2. Written or oral explanation of tools and equipment used in conversions and their uses 3. Observation of individuals or groups demonstrating skills of converting logs and evaluation of quality of timber produced

Carpentry and Joinery	
S2	**Module 4: Wood Preservation**
Description	By the end of this module learners will be able to identify the types of preservatives and their uses and understand the methods of wood preservation
Learning Outcomes	1. Identify types of preservatives and their uses 2. Explain the importance of preserving wood and the methods used in wood preservation 3. Demonstrate practical skills in preserving wood
Elements	1. Types: Tar-oil, water solution and organic solvents; Uses: protection of wood from rain, ground water, atmosphere 2. Non pressure: brushing, spraying, dipping; Pressure: pressure impregnation, full cell process and empty cell process. 3. Brushing, spraying, dipping, pressure impregnation.
Learning Strategies	1. Research the various types of wood preservatives and their uses. Present a report on findings. 2. Research and report on the importance of wood preservation and the methods of applications. 3. Practice the process of applying wood preservatives using a range of techniques
Assessment	1. Written or oral explanations of the various types of wood preservatives and their uses 2. Written or oral explanation of the importance of preservation and the methods of application 3. Observation of skills in applying preservatives. Evaluation of the standard of work by examination of finished task.

Carpentry and Joinery	
S2	**Module 4: Wood Preservation**
Description	By the end of this module learners will be able to identify the types of preservatives and their uses and understand the methods of wood preservation
Learning Outcomes	1. Identify types of preservatives and their uses 2. Explain the importance of preserving wood and the methods used in wood preservation 3. Demonstrate practical skills in preserving wood
Elements	1. Types: Tar-oil, water solution and organic solvents; Uses: protection of wood from rain, ground water, atmosphere 2. Non pressure: brushing, spraying, dipping; Pressure: pressure impregnation, full cell process and empty cell process. 3. Brushing, spraying, dipping, pressure impregnation.
Learning Strategies	1. Research the various types of wood preservatives and their uses. Present a report on findings. 2. Research and report on the importance of wood preservation and the methods of applications. 3. Practice the process of applying wood preservatives using a range of techniques
Assessment	1. Written or oral explanations of the various types of wood preservatives and their uses 2. Written or oral explanation of the importance of preservation and the methods of application 3. Observation of skills in applying preservatives. Evaluation of the standard of work by examination of finished task.

Carpentry and Joinery	
S2	**Module 5: Timber Seasoning**
Description	By the end of this module learners will be able to understand the reasons for seasoning and apply methods of seasoning and storage.
Learning Outcomes	1. Understand the term seasoning and the reasons for seasoning 2. Know methods of seasoning and storage 3. Demonstrate the application of methods of seasoning and storage
Elements	1. Seasoning: drying of timber to remove moisture content; 2. Reasons for seasoning: reduce weight, increase the strength, make it suitable for finishing, reduce transport cost, protection from decay and fungal infection. 3. Practical methods of seasoning: natural and artificial seasoning; methods of storage: stacking, spacing, control of heat.
Learning Strategies	1. Research in groups the term ‘seasoning’ and the reasons for seasoning timber; make presentation to class 2. Explore the methods of seasoning and storage of timber and report to class 3. Practise the procedure of seasoning and storage of timber
Assessment	1. Written or oral explanation of the term seasoning and the reasons for seasoning timber 2. Written or oral explanations of the methods of seasoning and timber storage 3. Observation of groups or individuals practicing procedures of seasoning and storage of timber

Carpentry and Joinery	
S2	**Module 6: Joints**
Description	By the end of this module learners will be able to identify the various types joints and demonstrate practical operations of framing and assembling joints
Learning Outcomes	1. Identify the various types of joints correctly and how and why each is used 2. Understand techniques of framing and assembling joints 3. Demonstrate practical skills in framing and assembling different types of joints
Elements	1. Joints: framing or corner, dovetail, widening, lengthening 2. Techniques of designing, measuring, marking, gauging, cutting, fitting 3. Practical application of these techniques
Learning Strategies	1. Explore the types of joints used in carpentry and joinery and work out how the different types are suited to different uses; make a presentation of conclusions 2. Research the techniques of making frames and assembling joints. Report how each technique is carried out and its importance 3. Practice skills in framing and assembling different types of joints
Assessment	1. Written or oral explanation of various types of joints used in carpentry and joinery 2. Written or oral explanation of skills and techniques of making frames and assembling different types of joints 3. Observation of skills during practice and evaluation of quality of completed products

Year 3

Carpentry and Joinery	
S3	**Module 1: Woodworking Machines**
Description	By the end of this module learners will be able to list types of machines, understand safety regulations and use machines appropriately
Learning Outcomes	1. List types of woodworking machines and their uses 2. Understand safety regulations in operating the machines 3. Demonstrate appropriate practical use of woodwork machines
Elements	1. Hand-feed surface planer, surface planer, thicknesser, circular saw, flatting and edging squares, combined surface planer and thicknesser 2. Safety rules: maximum guides; strong constructed guide; no adjustment and removing guides when on motion; clean working area; no use of machines when temperature 13 degree centigrade 3. Practical skills: Surface planing, make right thickness, cutting, edging square, cross cutting, ripping and mortising
Learning Strategies	1. In groups, using a range of sources, find out about different types of woodworking machines and produce a report identifying each and giving its use 2. Explore the risks associated with operating each machine and the safety regulations that apply to all machines and to each one specifically; produce a machine safety presentation 3. Practice appropriate practical uses of woodworking machines
Assessment	1. Written or oral explanation of types of woodworking machines and their uses 2. Written or oral explanations of the risks and of the principles of safe practice when using machines in the workshops 3. Observation of safe use of woodworking machines (CLOSE SUPERVISION NEEDED FOR NEW USERS)

Carpentry and Joinery	
S3	**Module 2: Doors and Windows**
Description	By the end of this module learners will be able to make and fix doors and windows
Learning Outcomes	1. Understand types of doors, windows and their functions 2. List correct materials for each type of door and window 3. Demonstrate practical skills in making and fixing doors and windows
Elements	1. Doors: Panel; flush; sash; casement; framed ledged and braced batten; ledged and braced batten Window: casement, sliding sash, bay, metal casement 2. Materials: timber, metal plates (stick plates), glass, nails, glue, paint, putty, hinges, hasp and staples, eye hook, l-lock, mortise lock, bolts, screws nails, sandpaper 3. Skills: design, measurement, cutting, planing, marking mortise and tenon, assembling, gluing, nailing, sanding, varnishing, welding, painting and fixing
Learning Strategies	1&2. In groups, research the types of doors and windows, their functions and the range of appropriate materials used for each 3. Practice in groups the skills in making and fixing doors and windows
Assessment	1&2. Written or oral explanation of different types of doors, windows, their functions and the correct materials use for each; make a presentation of findings 3. Observation of the skills of individuals in making and fixing doors and windows; evaluation of the quality of completed products / work

Carpentry and Joinery	
S3	**Module 3: Portable Power Hand Tools**
Description	By the end of this module learners will be able to describe the types of power hand tools, and use tools appropriately observing safety rules.
Learning Outcomes	1. Name and describe different types of portable power hand tools and their uses 2. Understand and observe safety rules in using portable power hand tools 3. Demonstrate skills in using portable power hand tools correctly
Elements	1. Electric drills, drill cutter, back hand, palm grip, powered plane, heavy duty router, jig-saw, plunge router, belt sander, orbited sander, chisel mortise and stand, circular saw 2. Understand operational manual before use, firm support of work piece, proper fixing of cutting guide, correct fixing of the blade, and proper handling of the machine when in use 3. Practise safe, accurate drilling, cutting, planing, mortising and sanding, correct fixing of the blade, proper handling of the machine when in use
Learning Strategies	1. Investigate in groups different types of portable power hand tools and present to class about their names, features and uses 2. Explore and become familiar with the safety rules in using portable power hand tools and report back to class 3. Practice the skills of using portable power hand tools correctly
Assessment	1. Written or oral explanation of different types of portable power hand tools and their uses 2. Written or oral explanation of safety rules in using each portable power hand tool 3. Observe individuals practising skills of using portable power hand tools correctly (CLOSE SUPERVISION NEEDED FOR NEW USERS)

Carpentry and Joinery	
S3	**Module 4: Scaffolding**
Description	By the end of this module learners will be able to understand the types of scaffolding and how they are used safely
Learning Outcomes	1. Understand the types of scaffolding and the reasons for their use 2. Understand the terms and materials used in scaffolding and how scaffolding is erected safely 3. Make safe use of scaffolding on the construction site
Elements	1. Ladder, trestle, putlog-tied (bricklayer's), independent-tied, system and mobile scaffolds Reasons: safe access to high buildings, stable working platforms, height advantage over ladders 2. Terms: Heavy duty, light trades, domestic Materials: timber, plots, pros and nails 3. Make safe use: proper support to avoiding sliding, tying of nuts and bolts, firm nailing
Learning Strategies	1. Groups investigate the types of scaffolding and the reasons for using scaffolding and present a report 2. Explore the terms and materials used in scaffolding and feed back findings to class 3. Practice safe use of scaffolding on the construction site
Assessment	1. Written or oral explanation of the types of scaffolding and the reasons for using it 2. Written or oral explanation of the terms and materials used in scaffolding 3. Observation of individuals practising safe use of scaffolding on the construction site; evaluation of quality of completed scaffolding

Year 4

Carpentry and Joinery	
S4	**Module 1: Roofs**
Description	By the end of this module learners will be able to list types of machines, understand safety regulations and use machines appropriately
Learning Outcomes	1. Define a roof and identify the types of roofs 2. Understand and use roof construction terminology appropriately 3. Use proper practice in setting out different types of roof trusses
Elements	1. Roofs are constructed on the walls of a room enclosure so as to save the space inside the wall from sun, rain and cold 2. Types of roofs: single and double roofs, pent, apex Terminology: roof trusses, span, rise, pitch line, pitch run, co-run, rafter run, rafter length, hip run, hip length, plumb cut, seat cut 3. Demonstration and practical experience of measuring, making of roof trusses, aligning, securing, nailing, application of preservative
Learning Strategies	1. Explore in groups what all roofs have in common and the various different types of roofs; present findings to class 2. Find out the meanings of terminology associated with roof construction and use terminology appropriately 3. Demonstrate using correct practice of setting out different types of roof trusses
Assessment	1. Written or oral description of the definition of a roof and identification of the different types of roofs. 2. Written or oral explanation of appropriate use of roof construction terminology 3. Observation of skills during the setting out of different types of roof trusses; evaluation of the quality of the product

Carpentry and Joinery	
S4	**Module 2: Arches and Centres**
Description	By the end of this module learners will be able to identify the types of arch, understand their function in building and be able to produce types of arch
Learning Outcomes	1. Identify the types of arches and explain the reasons for their use 2. Produce drawings of arches 3. Construct different types of arch
Elements	1. Reasons: Arched passages, windows and doors Types: segmental, semicircle, equilateral, drop and lancet arch 2. Drawing methods: setting out geometrical arch and centres using drawing tools, illustrating each type of arch 3. Practical construction of each type of arch following drawings accurately
Learning Strategies	1. Explore in groups the types of arches and why they are used; present conclusions to the class 2. Practise accurate drawings of different arches 3. Practise skills in making the different types of arch
Assessment	1. Written or oral explanation of the types of arch and their functions 2. Observation of skills while drawing; evaluation of quality of drawings produced 3. Observation of making skills; evaluation of quality of arches produced

Carpentry and Joinery	
S4	**Module 3: Formwork**
Description	By the end of this module learners will understand how to make temporary formwork
Learning Outcomes	1. Define the term formwork and identify types of formwork 2. Know and apply methods of making formwork boxes (moulds) and using them to make objects
Elements	1. Pre-casting and in-situ: mould boxes used in both Pre-casting: building blocks, paving slabs, lintels, coping stones, columns, beams and stairs In-situ: columns, walls, suspended floor and roofs 2. Practical processes: designing, measurement, cutting, nailing
Learning Strategies	1. In groups, research the meaning of the term 'formwork', identify types of formwork, methods of making formwork boxes (moulds) and methods of using boxes to make objects; present a report 2. Practise the application of the methods of making formwork boxes (moulds) and use them to make objects
Assessment	1. Written or oral explanations of the term formwork and identification of different types of formwork, methods of making formwork boxes and of using them 2. Observation of skills in making boxes and making the objects; evaluation of products: quality of formwork boxes (moulds) and the quality of the objects made

Carpentry and Joinery	
S4	**Module 4: Partitions**
Description	By the end of this module learners will understand how to construct partitions
Learning Outcomes	1. Identify the types of partition and why they are used 2. Understand the terminologies use in partitioning. 3. Understand the material use in partition construction and the reasons. 4. Demonstrate practical skills in constructing partitions.
Elements	1. Use of partitions: inexpensive conversion of a larger room into smaller rooms or spaces Types: timber stud, paramount and metal partitions. 2. Terminology: Stud, paramount, metal, frame, board 3. Materials: timber, plywood, metal, nails, bricks, chipboards, cement, plaster, sand and water; properties of materials 4. Practical skills: design, measurement, cutting, nailing/stapling, build, plastering, and painting.
Learning Strategies	1. In pairs or groups, explore why partitions are used and the types of partitions. 2. Find out the terminologies use in partitioning and their meanings; report to the class about 1 &2. 3. Explore the materials used in partition construction and the reasons why each is used; in groups, explain the options and reasons for choosing them to the class 4. Practise skills while constructing partitions
Assessment	1. Written or oral identify the types of partitions. 2. Written or oral explain the terminologies use in partitioning. 3. Written or oral explain the materials uses in partition construction and the reasons why. 4. Observe individuals' skills in constructing partitions; evaluate quality of final product

Carpentry and Joinery	
S4	**Module 5: Stairs**
Description	By the end of this module learners will be understand the function and construction of stairs
Learning Outcomes	1. Know the function of stairs, the terminology used and understand the principles of construction 2. Understand the procedures of designing stairs for different situations / locations 3. Investigate and explain the proper setting of stairs 4. Describe and apply the practical installation of stairs
Elements	1. Purpose: to enable safe and easy pedestrian movement between floors Terminology: tread, risers, banisters, hand rail 2. Design, choice of material, measurements, cutting and nailing 3. Accurate marking out and measurements 4. Use of timbers, nails, cements, aggregate and sand
Learning Strategies	1. In groups, explore the function and basic construction of stairs and the associated terminology; present findings to the class 2. Investigate the procedures of designing stairs for a variety of situations and locations 3. Practise accurate setting of stairs 4. Working as a group, practise the installation of stairs
Assessment	1. Written or oral explanation of the function, the terminology and the construction of stairs 2&3. Practical, oral or written demonstration of the procedures of designing and setting of stairs 4. Observation of skills in construction of stairs; evaluation of quality of product

Electrical Installation

Electrical Installation	
S1	**Module 1: Health and Safety**
Description	At the end of this module learners will be able to select the right tools and equipment for various tasks and use them appropriately, observing all the safety rules to avoid injury and harm.
Learning Outcomes	1. Explain the choice of appropriate tools and equipment for a range of tasks 2. Explain how to use each tool and piece of equipment correctly 3. Explain the risks of using tools inappropriately 4. Practice safe and effective use of tools, observing health and safety rules at all times.
Elements	1. Tools: cutting, stripping, long nose and combination pliers, drilling and cleaning machines, tester screw, flat and star screws 2. Tasks: appropriate tasks to practise use of tools listed in 1. 3. Risks: damage to tools and equipment, injury to self or others 4. Safety: follow instructions, no short cuts, develop learners' sense of responsibility for their own health and safety and that of others, maintain appropriate level of supervision to correct errors in practice and be aware of potential for accidents
Learning Strategies	1. Observe correct tools and equipment being used safely for a range of tasks 2&4. Practise safe and effective use of tools and equipment 3&4. Discuss in groups and agree the risks in using each tool incorrectly and produce a safety report / presentation for the class
Assessment	1. Oral or written explanation or observation of choice of appropriate tools and equipment for use in range of tasks. 2. Oral or written explanation or demonstration of how to use each tool and piece of equipment correctly. 3. Oral or written explanation of the risks of using tools inappropriately 4. Oral or written explanation or practical demonstration of the safe and effective use of tools and application of health and safety rules

Electrical Installation	
S1	**Module 2: Basic Electrical Quantities**
Description	At the end of this module the learner will understand and carry out calculations using six basic SI units of electrical quantity.
Learning Outcomes	1. Identify the six basic SI units. 2. Be able to convert different SI units 3. Explain standard units for measuring electrical quantities and carry out calculations
Elements	1. Units: Charge: Coulombs; Force: Joules & Newtons; Work: Joules & Newtons; Energy: Joules; Power: Watts 2. Conversions: C to J; J to KJ; W to KW 3. Quantities: charge, force, work, energy and power
Learning Strategies	1. Investigate and discuss in groups, the six basic SI units for measuring electrical quantity and produce a presentation explaining each 2. Carry out simple calculations converting SI units into different units 3. Investigate, practice and demonstrate how to calculate the five quantities; practise using SI units correctly in presenting results
Assessment	1. Oral or written explanation of the six basic SI units 2. Oral or written evidence of correct calculations changing SI units to different units 3. Oral or written explanation or observation of practice of calculating charge, force, work, energy and power and using units correctly

Electrical Installation	
S1	**Module 3: Measuring Instruments**
Description	At the end of this module the learners will be able to apply and use different types of electrical measuring instruments and determine the measurement error.
Learning Outcomes	1. Correctly identify different type of measuring instruments use for measuring current, voltage, resistance and power 2. Be able to use measuring instruments to determine the values of current, voltage, resistance and power 3. Identify some simple faults and errors in using measuring instruments
Elements	1,2&3. Instruments: ammeter, voltmeter, analogue and digital multi-meters
Learning Strategies	1. Investigate or research different types of measuring instruments use for measuring current, voltage, resitance and power 2. Investigate and practise using measuring instruments to determine the values of current, voltage, resistance and power accurately 3. In groups, develop ideas for using electrical instruments for accurate measurement and for checking for faults and quantifying error in making measurements; put these into practice
Assessment	1. Oral or written explanation or observation of selection of the right types of measuring instruments for measuring current, resistance, voltage and power 2. Oral or written explanation or observation of practice when using measuring instruments to determine the values of current, voltage, resistance and power 3. Oral or written descriptions of key points for making accurate measurements and determining measurement error or observation of performance in making measurements

Electrical Installation	
S1	**Module 4: Electrical Symbols**
Description	At the end of this module the learners will be able to draw the standard symbols used in electrical installation
Learning Outcomes	1. Identify the standard symbols used in the field of electrical engineering. 2. Be able to use electrical symbols to identify various electrical accessories
Elements	1&2. Symbols: (electrical accessories) switch, switchgear, lamps, current conductors, battery, fans, sockets, resistors, inductors, fuse, relay, motor, transformer, rotary machine, circuit elements
Learning Strategies	1. In groups, read and interpret standard electrical symbols used in the field of electrical engineering and present findings 2. Practise use of electrical symbols to identify various electrical accessories
Assessment	1. Oral or written explanation of how to identify standard symbols in the field of electrical engineering 2. Oral or written explanation to show understanding of how to identify various electrical accessories from electrical symbols

Electrical Installation	
S1	**Module 5: Simple D.C circuit**
Description	At the end of this module the learners will be able to identify simple DC circuits and carry out simple calculations in finding values of resistance, current and voltage.
Learning Outcomes	1. Be able to identify and explain series, parallel and combination circuit 2. Carry out simple calculations of voltage, current and resistance in series, parallel and combination circuit
Elements	1&2. Circuits: Series, parallel and combination; DC power source, wire
Learning Strategies	1. In groups, investigate, research or discuss series, parallel and combination circuit in a simple dc circuit and explain how their characteristics to the class 2. Perform simple calculations to find values of current, resistance and voltage in series and parallel circuits
Assessment	1. Oral or written explanations of series, parallel and combination circuit 2. Oral or written explanation of results of calculations to find values of resistance, current and voltage using simple calculation in series, parallel and combination circuit

Electrical Installation	
S1	**Module 6: Cable and colour codes**
Description	At the end of this module the learners will be able to explain and select and use the appropriate colour code in electrical work with cables.
Learning Outcomes	1. Be able to explain colour codes in electrical cable 2. Be able to select the correct cable for different uses in electrical work by use of the colour code
Elements	1&2. Cable colour code: red, black, blue, yellow, yellow-green, green, gray, brown, white and the significance of each
Learning Strategies	1. In groups, investigate the colour code in electrical cables and produce a chart to explain 2. Practise correct usage of cables through the use of the colour code when carrying electrical work
Assessment	1. Oral or written evidence of ability to identify cables correctly by use of the colour code 2. Oral or written how to select and use cables correctly by the colour code when carrying out electrical work

Electrical Installation	
S1	**Module 7: Electrical diagrams**
Description	At the end of this module the learner will be able to classify and use the correct electrical diagrams in different circuits
Learning Outcomes	1. Be able to classify different electrical diagrams 2. Be able to apply/use the right diagrams in given tasks
Elements	1&2. Diagrams: Plan/line diagram, schematic diagram and wiring diagram
Learning Strategies	1. In groups discuss, investigate, identify and classify different types of electrical diagrams; explain findings to class 2. Practise use of different types of electrical diagrams in different tasks and demonstrate correct use
Assessment	1. Oral or written explanation of how to identify and classify the electrical diagrams 2. Oral or written explanation or observation of how to use the right diagrams in a given tasks

Year 2

Electrical Installation	
S2	**Module 1: Chemical Effect of Electricity**
Description	At the end of this module the learner will be able to understand the chemical effects of electricity.
Learning Outcomes	1. Be able to define electrolysis and explain its applications including electro-plating 2. Be able to explain the purpose and function of a simple dry cell 3. Be able to explain how to distinguish between primary cell and secondary cell and give advantages and disadvantages of each 4. Be able to perform calculations of voltage drop accurately using V = E-IR
Elements	1. Definitions: Electrolysis is the process by which substances are decomposed (broken down) into simpler substances when an electric current is passed through them; Electroplating is a process that uses electric current to convert metal ions in a solution into a coherent metal coating on an electrode 2. Dry cell: purpose, structure and function 3. Primary cells are batteries that cannot be recharged after use, secondary cells can be recharged 4. V= E-IR
Learning Strategies	1. Group discussion, investigate and research on electrolysis and its application including electro plating and report back to the class. 2. Investigate in groups and carry out experiment to research function of a simple dry cell to convert chemical energy to electrical energy and make a presentation in the class. 3. Group discussion to compare advantages and disadvantages of primary cells and secondary cells and produce a report 4. Practice carrying out simple calculations to determine voltage drop.
Assessment	1. Oral or written definition of electrolysis and explanation of its applications including electro plating 2. Oral or written explanation of the purpose, structure and function of a simple dry cell 3. Oral or written explanation of how to distinguish between primary cell and secondary cell and the advantages and disadvantages of each 4. Written evidence of correct use of the formula

Electrical Installation	
S2	**Module 2: Voltage, Current and Resistance in Electrical Circuits.**
Description	At the end of this module the learner will understand the relationship between and be able to calculate voltage, current and resistance in electrical circuits.
Learning Outcomes	1. Be able to state Ohm's laws 2. Be able to apply Ohm's laws to determine the values of resistance, current and voltage in electrical circuits 3. Be able to explain the relationship between voltage, current and resistance 4. Understand resistance as opposition to flow of current
Elements	1. Ohm's Law: the current flowing through a circuit is directly proportional to the voltage 2&3. Use of V=IR to calculate V, I or R; express relationship between V, I & R in words 4. Use of conductors with different resistance = different opposition to flow of current
Learning Strategies	1. Research and practise stating Ohm's law 2&3. Practise using the formula V = IR and manipulating the formula to calculate the values of resistance, voltage, current in an electrical circuit and to explain the relationship between V, I and R 4. Practise using the formula to explain resistance as opposition to the flow of current
Assessment	1. Written or oral statement of Ohm's law 2&3. Written evidence of correct use of the formula with each of V,I and R as the subject; written or oral explanation of the relationship between V, I and R 4. Written or oral explanation of concept of resistance as opposition to flow of current

Electrical Installation	
S2	**Module 3: Switches**
Description	At the end of this module the learner will be able to identify different types of switches and correctly connect the terminals to the conductor
Learning Outcomes	1. Be able to identify different types of switches and their terminals correctly 2. Be able to use and represent different types of switches appropriately in various circuit diagrams 3. Be able to apply different types of switches appropriately for particular uses in circuits
Elements	1&2. Switches: simple switch, two way switch, intermediate switch, double poles, three poles, push-button, change-over, main switch 3. Use of each type of switch
Learning Strategies	1. Investigate and research different types of switches, the terminals each has and how they are connected 2. Practise in groups how to draw different types of switches and their connections in electrical circuits diagrams 3. In groups, practise selecting the right types of switches for a various circuits and connecting them correctly
Assessment	1. Oral or written explanation of the types of switches and their terminals 2. Evaluation of quality of drawings representing different types of switches and their connections in electrical circuits 3. Observation of performance in applying learning when selecting the right switches for various circuits and connecting them appropriately; evaluation of products ie completed circuits

Electrical Installation	
S2	**Module 3: Switches**
Description	At the end of this module the learner will be able to identify different types of switches and correctly connect the terminals to the conductor
Learning Outcomes	1. Be able to identify different types of switches and their terminals correctly 2. Be able to use and represent different types of switches appropriately in various circuit diagrams 3. Be able to apply different types of switches appropriately for particular uses in circuits
Elements	1&2. Switches: simple switch, two way switch, intermediate switch, double poles, three poles, push-button, change-over, main switch 3. Use of each type of switch
Learning Strategies	1. Investigate and research different types of switches, the terminals each has and how they are connected 2. Practise in groups how to draw different types of switches and their connections in electrical circuits diagrams 3. In groups, practise selecting the right types of switches for a various circuits and connecting them correctly
Assessment	1. Oral or written explanation of the types of switches and their terminals 2. Evaluation of quality of drawings representing different types of switches and their connections in electrical circuits 3. Observation of performance in applying learning when selecting the right switches for various circuits and connecting them appropriately; evaluation of products ie completed circuits

Electrical Installation	
S2	**Module 4: Socket Outlets**
Description	At the end of this module the learner will be able to identify and install socket outlets in ring circuits and spurs.
Learning Outcomes	1. Be able to identify different types of socket outlet 2. Understand the meaning of ring and spur and be able to connect sockets in ring and spur correctly
Elements	1. Socket outlets: single and double, two pin and three 2. Ring circuits or mains: ring of wires through a building connected to power source at both ends; Spur: side branch from ring circuit connected through a socket or junction box
Learning Strategies	1. In groups, research and investigate different types of socket outlets and agree reasons for selecting each; present a report 2. In groups, practise identifying ring circuits and spurs in circuit diagrams and practise connecting socket outlets in rings and to spurs
Assessment	1. Oral or written explanation of the different types of socket outlets and their uses 2. Oral or written explanation of ring circuits and spurs; evaluation of quality of work connecting sockets in rings and spurs

Electrical Installation	
S2	**Module 5: Lighting Fittings**
Description	At the end of this module the learner will be able to install different types of lighting fittings in series, in parallel and in combination.
Learning Outcomes	1. Be able to identify different types of lamps and lamp holders 2. Be able to connect different types of lamps in series, parallel and combination
Elements	1. Lamps: Bulbs, fluorescent tubes; lamp holders: pin type and screw type bulb holders, fluorescent fitting 2. Circuits: series, parallel and combination
Learning Strategies	1. In groups, research and investigate different types of lamps and lamp holders and report to class 2. Practise connecting lamps in circuits in series, in parallel and in combinations
Assessment	1. Oral or written explanations of different types of lamps and lamp holders 2. Observation of skills in connecting lamps in series, parallel and combinations, evaluation of quality of work carried out

Electrical Installation	
S2	**Module 6: Switchgear**
Description	At the end of this module the learner will understand different types of switchgear and connect accordingly
Learning Outcomes	1. Be able to explain types of switchgear and their uses 2. Be able to identify different types of switchgear, both in circuit diagrams and the real articles and understand how they are connected to ensure they work correctly 3. Be able to connect types of switchgear in circuits
Elements	1. Switchgear: Single pole, three pole, multiline, isolator, change over 2. Real examples of each and a range of circuit diagrams including each
Learning Strategies	1. Research and investigate the types of switchgear used in electrical control systems and their uses, present conclusions to class 2. Practise interpreting circuit diagrams with switchgear and handling the types of switchgear and their connections 3. Practise connecting different types of switchgear in electrical circuits
Assessment	1. Oral or written explanation of types of switchgear and their uses 2. Oral and written explanations of circuit diagrams including switchgear and identifying actual examples of different types of switchgear 3. Evaluation of quality of work connecting switchgear in circuits

Electrical Installation	
S2	**Module 7: Fans**
Description	At the end of this module the learner will be able to identify, connect and troubleshoot faults in different types of fans.
Learning Outcomes	1. Be able to identify type of fans 2. Be able to connect different types of fans 3. Be able to identify faults in fans and carry out repairs
Elements	1. Fan types: ceiling, side-fitting, exhaust fans 2. Connection of all three types 3. Identification and repair of common faults
Learning Strategies	1. In groups, research and investigate different types of fans and complete a report 2. Practise connecting different types of fans 3. Practise identifying faults in fans and carrying out repairs
Assessment	1. Oral or written explanations of identification of different type of fans 2. Evaluation of quality of connections of different types of fans 3. Evaluation of effectiveness of fault finding and repair

Year 3

Electrical Installation	
S3	**Module 1: Magnetism**
Description	At the end of this module the learner will understand the key principles of magnetism
Learning Outcomes	1. Be able to state the basic law of magnetism. 2. Be able to define magnetic field and magnetic flux and to demonstrate how to see lines of force. 3. Be able to determine the direction of magnetic field.
Elements	1. Law: Opposite poles of a magnet attract each other. Like poles repel. 2. Definitions: A magnetic field is the magnetic effect of magnets and electric currents, Magnetic flux is the amount of magnetic field (also called “magnetic flux density”) passing through a surface such as a conducting coil; Investigating fields and flux: Bar magnets, conducting wires, card, iron filings, 3. Investigating direction of fields: Bar magnets, conducting wires, card, plotting compasses
Learning Strategies	1. In groups, research the laws of magnetism and explain findings to class 2. Explore magnetic field lines and magnetic flux lines and demonstrate effective technique of showing lines 3. Investigate the direction of a magnetic field and report findings in relation to poles of magnets and direction of flow of current
Assessment	1. Oral or written explanation of law of magnetism 2. Oral or written explanation or practical demonstration of technique for identifying magnetic fields and magnetic flux lines 3. Oral or written explanation or observation of experimental technique to determine the directions of magnetic fields

Electrical Installation	
S3	**Module 2: Electro-magnetism**
Description	At the end of this module the learner will be able to determine the force and direction of motion of a current-carrying conductor when placed in a magnetic field
Learning Outcomes	1. Be able to explain the relationship between the current in a current-carrying conductor, the lines of force in a magnetic field and the motion of the conductor. 2. Be able to determine the magnetic poles in a current carrying conductor 3. Be able to perform calculations using F = BIL and F =BILsinθ
Elements	1. Equipment: power source, ammeter, voltmeter, magnets, conducting coil 2. Equipment: power source, magnets, plotting compasses
Learning Strategies	1. In groups, carry out experiments to investigate (a) the field around a current carrying conductor and its direction, (b) the lines of force in a magnetic field and (c) the direction of motion when a current carrying conductor is placed in a magnetic field; Use Fleming's left hand rule to predetermine the direction of motion of a current carrying conductor in a magnetic field; report conclusions to class 2. Investigate magnetic poles of a current carrying conductor; report findings to class 3. Practise use of the formula to calculate: force, current, magnetic flux, length and direction of motion (represented by θ)
Assessment	1. Written or oral explanation of relationship between current, magnetic field and motion in a current carrying conductor 2. Oral or written explanation or observation of technique for determining the magnetic poles in a current carrying conductor 3. Written evidence or observation of correct use of formula

Electrical Installation	
S3	**Module 3: Power Supply**
Description	At the end of this module the learner will be able to identify different types of energy sources, distribution and power transmission systems
Learning Outcomes	1. Be able to explain different types of energy sources and power plants for producing electricity 2. Be able to explain transmission and power distribution systems
Elements	1. Energy sources: Coal, oil, gas, tidal, nuclear solar wind, hydro power plants: Power plants: coal, gas, oil, solar, hydro-electric, wind, nuclear, tidal 2. Transmission: over-head and underground cables; Distribution systems: transformers, boosters, circuit breakers
Learning Strategies	1. Group discussions, visits to different types of power plants, research using range of sources; produce presentation 2. Group visits, discussions of transmission and distribution systems, research using different sources; produce presentation
Assessment	1. Oral or written explanations of different types of energy sources and power plants for producing electricity 2. Oral or written explanations of components and functions of power transmission and distribution systems

Electrical Installation	
S3	**Module 3: Power Supply**
Description	At the end of this module the learner will be able to identify different types of energy sources, distribution and power transmission systems
Learning Outcomes	1. Be able to explain different types of energy sources and power plants for producing electricity 2. Be able to explain transmission and power distribution systems
Elements	1. Energy sources: Coal, oil, gas, tidal, nuclear solar wind, hydro power plants: Power plants: coal, gas, oil, solar, hydro-electric, wind, nuclear, tidal 2. Transmission: over-head and underground cables; Distribution systems: transformers, boosters, circuit breakers
Learning Strategies	1. Group discussions, visits to different types of power plants, research using range of sources; produce presentation 2. Group visits, discussions of transmission and distribution systems, research using different sources; produce presentation
Assessment	1. Oral or written explanations of different types of energy sources and power plants for producing electricity 2. Oral or written explanations of components and functions of power transmission and distribution systems

Year 4

Electrical Installation	
S4	**Module 1: Kirchhoff's Laws**
Description	At the end of this module the learner will be able to use Kirchhoff's laws to explain the relationship between resistance (R), current (I) and voltage (V) and calculate the values of R, I and V.
Learning Outcomes	1. Be able to explain the relationship between resistance, current and voltage using Kirchhoff's Laws 2. Perform calculations using Kirchoff's laws
Elements	1. Circuits: wire, power supply, voltmeter, ammeter 2. Voltage: $V=E_1-E_2=I_1R_1-I_2R_2$, Current: $I_1 + I_2 = I_3$
Learning Strategies	1. Group research and discussion of Kirchhoff's laws and carry out experiments to determine resistance, current and voltage 2. Group discussions and practise calculations using Kirchhoff's laws in determining resistance, current and voltage in a circuit
Assessment	1. Oral or written explanation of the relationship between resistance, current and voltage with reference to Kirchoff's laws 2. Carry out calculations to determine V, I and R using Kirchoff's laws

Electrical Installation	
S4	**Module 2: Generators**
Description	At the end of this module the learner will be able to identify, dismantle, sketch and assemble electrical parts of the generators
Learning Outcomes	1. Be able to identify different electrical components of generators and explain their functions 2. Be able to identify faulty parts of generators 3. Be able to dismantle and re-assemble electrical parts of generators
Elements	1. Components: coil, rotor, commutator, brush, armature 2. Faults in these components
Learning Strategies	1. Through group discussions, investigation, visits, explore functions and reliability of different electrical components of generators 2. Practise investigating faulty electrical parts 3. Practise maintenance of generators, dismantling and re-assembling electrical parts
Assessment	1. Oral or written explanations of different electrical components of generators and their functions 2. Oral or written explanations of practice in identifying faulty parts or evaluation of practical work 3. Oral or written explanations or practical demonstration of dismantling and re-assembling electrical parts of generator in carrying maintenance work

Electrical Installation	
S4	**Module 3: D.C and A.C motors**
Description	At the end of this module the learner will be able to identify components of D.C. and A.C. motors, to connect them using star and delta connections, to identify types of relays and contactors and to maintain and troubleshoot motors
Learning Outcomes	1. Be able to identify parts of motors and their functions 2. Be able to use star or delta connections when connecting motors 3. Be able to identify different types of relays and contactors 4. Be able to carry out routine maintenance and servicing of motors and to troubleshoot faults
Elements	1. Motors and components: D.C. motor, A.C. motor, rotor, brush, armature, commutator, relays and contactors 2. Star and delta connections 3. Relays: Solid state, electro-mechanical, Reed, AC, DC, safety, meter; Contactors as special purpose relays: definite purpose, capacitor switching 4. Routine servicing and troubleshooting common faults
Learning Strategies	1. Carry out group discussions, investigate and research parts of a motor and their functions using different sources 2. Practise connecting motors using star or delta connections and demonstrate effective procedure 3. Research different types of relays and contactors and their functions; report findings to class 4. Practise routine maintenance and servicing; practise investigating and carrying out tests for faults and repairing them
Assessment	1. Oral or written explanation of parts of motors and their functions 2. Oral or written explanation or practical demonstration of correctly connecting motors in star or delta 3. Oral or written explanations of different types of relays and contactors and their functions 4. Oral or written explanation or practical demonstration of practice in servicing and maintaining motors and carrying out troubleshooting.

Plumbing and Pipe Fitting

Plumbing And Pipe Fitting	
S1	**Module 1: - Introduction to Plumbing**
Description	By the end of this unit learners will be able to understand and describe the components and purposes of a plumbing system and to use basic plumbing tools correctly
Learning Outcomes	1. Understand the components and basic functional requirements of a plumbing system and know the types of basic tools, equipment and materials and how to use them 2. Be able to use tools, equipment and materials correctly
Elements	1. Description: plumbing is a system of pipes, drains, fittings, valves and fixtures for distribution of water for drinking (potable water), heating, washing and for waste removal Basic tools: hacksaw, pipe cutters, chisels, hammer, pipe wrench and others Equipment: wheel barrow, buckets and basic machines Materials used: plastic pipes, galvanized pipes, copper and steel pipes, pipe fittings 2. Normal uses of tools, equipment and materials
Learning Strategies	1. In groups, discuss the purposes and components of a plumbing system and list the basic tools, equipment, materials and their uses; make a presentation 2. Working in groups, practise a range of tasks using appropriate tools, equipment and materials.
Assessment	1. Written or oral explanation of the purpose, components and basic functional requirements of a plumbing system and of the types of basic tools, equipment and materials and their uses 2. Observation of correct practice and safe use of the basic tools, equipment, materials and evaluation of the quality of work

Plumbing And Pipe Fitting	
S1	**Module 2: Safety Rules and Regulations**
Description	By the end of this unit learners will be able to understand the safety rules and regulations and apply them in practice.
Learning Outcomes	1. Understand safety rules and regulations and the reasons for them 2. Demonstrate application of safety rules and regulations in practice
Elements	1. Safety rules: handling tools; storing tools; workshop cleanliness; safe use of tools, equipment and materials; use of protective clothing Regulations: use of facilities and building standards 2. Practical application of safety rules and regulations
Learning Strategies	1. In groups, discuss and list the safety rules and regulations and the reasons for each of them; make a presentation 2. Working in groups, perform plumbing tasks making use the hand tools, equipment, materials, facilities in the workshop, applying the safety rules and regulations correctly
Assessment	1. Written or oral explanation of the safety rules and regulations and the reasons for them 2. Observe the skills in applying safety rules and regulations in using tools, equipment and materials and wearing protective clothing

Plumbing And Pipe Fitting	
S1	**Module 3: Basic Tools and Equipment**
Description	By the end of this unit learners will understand the purpose and use of the basic tools and equipment, and will be able to use them appropriately
Learning Outcomes	1. Understand names, groups and correct uses of basic tools and equipment 2. Apply the use of tools and equipment appropriately
Elements	1. Tools and equipment: hacksaw, pipe cutter, dies, spanners and pipe wrench 2. Applications: threading, cutting and overhauling
Learning Strategies	1. In groups, discuss, name and classify basic tools and equipment; sketch them and match types of plumbers' tools and equipment correctly with their uses; make presentation 2. Working in groups, perform tasks, using the listed tools and equipment appropriately
Assessment	1. Written or oral explanation or sketch naming and grouping tools and equipment correctly and giving their uses 2. Observation of selection and appropriate use of tools and equipment

Plumbing And Pipe Fitting	
S2	**Module 4: Basic Plumbing Materials**
Description	By the end of this unit learners will understand the purposes of plumbers' materials, identify their types and uses and apply correct practice when using them
Learning Outcomes	1. Understand the names, types, purposes and uses of plumbing materials 2. Demonstrate correct practice when using the materials
Elements	1. Materials and types: pipes and tubes made of steel, copper or plastic; fittings - valves, elbows, tees, and unions; fixtures – toilets, showers, bathtubs, sinks; sealants Properties: malleability, elasticity, durability and plasticity Purposes: installation, sanitary work and plumbing pipework, drainage 2. Correct methods applied to cutting pipes, threading pipes, joining pipes, excavation of trenches, fixing sanitary fitting and laying pipes to gradients
Learning Strategies	1. In groups, discuss the plumbing materials, list the names, properties and purposes; make a presentation 2. Working in groups, practise using the plumbing materials appropriately
Assessment	1. Written or oral explanation of the names, types, purposes and uses of plumbing materials 2. Observation of practice and check the quality of the product

Senior Two Modules

Plumbing And Pipe Fitting	
S2	**Module 1: Taps and Valves**
Description	By the end of this unit learners will understand the types of taps and valves, their importance and their operation and will be able to install them
Learning Outcomes	1. Describe the types of taps and valves, understand their importance and their operation 2. Be able to install taps and valves correctly
Elements	1. Descriptions: Taps and valves are made of brass, gun metals or other corrosion resisting alloys by casting metal into moulds or by hot pressing metal between dies Types of taps and valves: Bib taps, pillar taps, super taps, stop valves, gate valves and others Importance and operation: control of flow (usually of water) either by hand or automatically 2. Installation tasks variety of taps and valves
Learning Strategies	1. In groups, discuss the description, types, importance and functions of taps and valves; make a presentation 2. Practise fitting taps and valves
Assessment	1. Written or oral explanation of the description, types, importance and operation of taps and valves 2. Observation of the skills involved in installation of taps and valves, evaluation of quality of completed task

Plumbing And Pipe Fitting Modules	
S2	**Module 2: Sanitary Fittings**
Description	By the end of this unit learners will know the types of sanitary fittings, will be able to identify the correct positions for fittings, and will be able to demonstrate correct methods for fitting the various types of fittings.
Learning Outcomes	1. Understand that sanitary fittings are appliances used in the building, know the names and types of sanitary fittings, what they are made of and where they are normally positioned 2. Demonstrate the skills for selecting the right positions for each sanitary fitting and installing them appropriately
Elements	1. Sanitary fittings: wash basin, sink, bath tub, urinal, water closet and flushing cistern and water tank Types (uses) of sanitary fittings – washing: wash basin for hand washing, sink used in kitchen and laboratory, bath tub; sewage: urinal used for disposal of urine, water closet (WC) used for dispatching excreta; storage: water tank, flushing cistern for WC Manufacture: most sanitary fittings are made from ceramics, glazed fire clay and earthen ware (china ware), sometimes plastic for baths, cisterns and steel for baths Positions: wash basin in dining hall, door way or bathroom; sink in kitchen or laboratory; urinal in toilets, bath tub in the bathroom, WC in its room and flushing cistern in WC room 2. Positions and methods of installing the sanitary fittings
Learning Strategies	1. In groups, discuss and explain the names, types, uses and positions of the sanitary fittings; make a presentation in the class 2. In groups, discuss the positions and methods of installation of sanitary fittings and, individually, practise the methods installing the different types of sanitary fittings
Assessment	1. Written or oral explanation of the names, types, uses and correct positions of sanitary fittings 2. Observation of the skills involved in choosing the positions and installing the different types of sanitary fitting; evaluation of the quality of the work

Plumbing And Pipe Fitting Modules	
S2	**Module 3: Water Distribution System**
Description	By the end of this unit learners will know the two distinct systems for carrying water to a building from the main and will know how to install pipes to the main
Learning Outcomes	1. Understand and describe the two distinct systems for carrying water to a building from the main 2. Describe the purposes of the water distribution system and the methods of installing the pipe lines 3. Practice the methods for laying the two systems of pipe lines
Elements	1. Description: direct pipe system (upward distribution system) supplies water to various floors in the building from the mains; indirect pipe system (down take supply) feeding water directly to storage tank in the roofs or underground and later pumped to storage tank at roof level 2. Purposes: to supply water from the main to the building to avoid the need for fetching and carrying Methods: below ground and above ground pipe lines for direct and indirect systems 3. Application of skills in laying and installing pipe lines
Learning Strategies	1. In groups, discuss the names and features of the two distinct water distribution systems and make presentation in the class 2. In groups, discuss the purposes of the water distribution systems and the methods of installing them 3. In groups, lay and install the two water distribution systems
Assessment	1. Written or oral explanation of the names and features of the two water distribution systems 2. Written or oral explanation of the purposes of mains water distribution and the methods of the two types 3. Observation of the skills in laying / installing the two distinct water distribution systems; evaluation of the quality of work

Plumbing And Pipe Fitting Modules	
S2	**Module 4 : Cold Water Supply**
Description	By the end of this unit learners will know the two types of systems for conveying cold water around a building and understand the functional requirements of cold water storage.
Learning Outcomes	1. Understand the two types of system used for conveying cold water to sanitary fittings and the functional requirements of the cold water storage cistern and of frost protection 2. List and describe the types of materials used for installation of the cold water pipe system 3. Be able to install the two types of cold water supply to fittings and to protect pipes against frost
Elements	1. Descriptions: direct system - the whole of the cold water supply to the sanitary fittings is supplied directly from the service or main pipe; indirect system - cold water supplied indirect from a cold water storage cistern position at a high level (roof space or platform) Functional requirements: cistern should be adequately supported and installed in such a position as give reasonable access for maintenance; installed so that its outlets are above the highest discharged point on the sanitary fitting; frost protection should be thick enough to insulate all exposed pipework at risk from frost 2. Materials and uses: pipes - copper, polyvinyl chloride; cisterns - polythene, galvanized steel; pipe trench filling - sand 3. Installation of pipes, cisterns and frost protection
Learning Strategies	1. In groups, discuss the types of cold water supply (direct and indirect systems) and the functional requirements of cisterns and frost protection; make a presentation in the class 2. In groups, discuss the materials required in the systems and their uses; make a presentation 3. Working in groups; practise installing the two different cold water supply systems and protecting against frost
Assessment	1. Written or oral explanation of the two cold water supply systems and the functional requirements of cisterns and frost protection 2. Written or oral explanation of the materials used for installing the systems and their functional requirements 3. Observation of the skills involved in installing the two different cold water systems supply pipes; evaluation of the quality of the products

Plumbing And Pipe Fitting Modules	
S2	**Module 5: Hot Water Supply**
Description	By the end of this unit learners will understand the two systems for providing hot water in a building, the functional requirements of hot water storage cylinders and protection against frost.
Learning Outcomes	1. Understand the two types of systems for providing hot water in a building, the materials required and their properties and the functional requirements of the hot water storage cylinders 2. Be able to install the two systems and protect the pipes against frost
Elements	1. Descriptions of the two systems: direct - heats water as it is used; indirect - contains a storage cylinder that stores hot water, heated by a coil or annulus that is connected to the flow and return pipes from the boiler. Materials: copper, galvanized steel and plastic pipes Functional requirements: Hot water storage cylinders are produced to standard sizes and capacities with insulation and positions for screwed holes for pipe connections 2. Practical installation and frost protection
Learning Strategies	1. In groups, discuss the two types of systems (direct and indirect), the materials involved and the functional requirements of hot water storage cylinders; make presentations in the class 2. Working in groups, practise installing the two different hot water pipe systems and frost protection
Assessment	1. Written or oral explanation of the two types of hot water pipe system, the types of materials used and their properties and the functional requirements of hot water storage cylinders 2. Observation of the skills in installing the pipework of the two hot water systems; evaluation of the quality of work

Plumbing And Pipe Fitting Modules	
S2	**Module 6: Sheet Metal Work (Sheet Lead Work) (1)**
Description	By the end of this unit learners will understand sheet lead, its properties and uses, will know the types of sheet lead, tools and equipment used in cutting sheet lead and the methods and procedures involved in lead work.
Learning Outcomes	1. Understand and describe sheet lead and its properties, uses, types and sizes of sheet lead, the tools and equipment used for cutting and bossing it. 2. Be able to apply the methods and procedures for carrying out lead work
Elements	1. Description and properties: Sheet lead is a heavy, easily shaped metal, widely used for roofing and channelling water Types and sizes: cast sheet lead and rolled sheet lead supplied as metal plate or coils in widths ranging from 150 – 600 mm; going up from 150 mm in steps of 30mm, i.e. 150, 180 etc; lengths are 3, 6 or 9 metres Tools and equipment: spirit based marker pen, straight edge steel rule and bossing tools 2. Practical measuring, marking, cutting, laying and shaping
Learning Strategies	1. Discuss and explain the types of sheet lead, its properties and uses, sizes, tools and equipment used for cutting the sheet lead and make presentations 2. Working in groups; practise measuring, marking, cutting and laying the sheet lead
Assessment	1. Written or oral explanation of the properties, uses, types and sizes of sheet lead and the tools and equipment used for cutting the sheet lead to the required size and using it 2. Observation of skills in marking, cutting and using sheet lead; evaluation of the quality of products

Senior Two

Plumbing And Pipe Fitting Modules	
S3	**Module 1: Drainage**
Description	By the end of this unit learners will understand drainage systems, identify the positions where drainage systems are set and know the appropriate materials.
Learning Outcomes	1. Describe drainage systems, understand their importance and functions, explain the positions where drainage systems are set and the methods and materials used for their construction 2. Demonstrate the skills used in constructing drainage systems
Elements	1. Description and importance: a drainage system consists of horizontal pipes set underground for draining of discharge from soil, waste, storm and ventilation pipes Positions: below ground level, ground level and above the ground Types of pipes: soil pipes, waste pipes, storm pipes, vent pipes, stack, sewer, trunk sewer Materials / composition of pipes: cast iron, mild steel, asbestos, polyvinyl chloride, stoneware, reconstructed concrete Tools and equipment for trenching and pipework Methods: trenching, laying, levelling, connecting pipework 2. Practical construction of drainage systems
Learning Strategies	1. In groups, discuss drainage systems, describe them, explain their importance and functions; describe the methods of constructing drainage systems, the materials, tools and equipment required; make presentation in the class 2. Working in groups, carry out the work of laying drainage piping and setting drains, observing safety rules
Assessment	1. Written or oral description of drainage systems and explanation of their importance and functions, the positions where they are set and the methods, tools, equipment and materials used for their construction 2. Observation of skills in working in the trenches and laying drainage pipes, applying the safety rules; evaluation of the quality of the work

Plumbing And Pipe Fitting Modules	
S3	**Module 2 : Drainage above ground**
Description	By the end of this unit learners will understand the composition of drainage above ground sanitary pipe work systems, and be able to connect the pipes used.
Learning Outcomes	1. Describe and understand the composition of the drainage system provided for conveying sanitary sewage to the underground drainage system for final disposal 2. Describe and list the types of the pipes used in the installation of the above ground drainage 3. Be able to install systems of drainage pipes above the ground
Elements	1. Description: drainage above the ground is a pipe system that consists of a system of vertical stacks, horizontal branches, floor traps provided for conveying soil and waste waters, storm water to the underground drainage system for final disposal 2. Types of pipes: cast iron, reinforced concrete, pre-stressed concrete, mild steel, wrought iron, asbestos and polyvinyl chloride pipes 3. Method of connecting pipes: cement or lead
Learning Strategies	1. In groups, discuss the purpose and composition of drainage above the ground; make a presentation 2. In groups, discuss the types of pipes used in the installation of drainage systems above ground, explaining reasons for using each; make a presentation 3. Working in groups, practise the installation of the drainage system above the ground
Assessment	1. Written or oral description of drainage systems above the ground and their purpose 2. Written or oral listing of the types of pipes used in the installation of drainage above the ground and the reasons for using each type 3. Observation of skills when installing drainage systems above the ground; evaluation of the quality of the work

Plumbing And Pipe Fitting Modules	
S3	**Module 3: System Of Plumbing For House Drainage**
Description	By the end of this unit learners will understand the four systems for plumbing house drainage, the types of materials used and fix the pipes using the correct methods.
Learning Outcomes	1. Name and describe the four plumbing systems used for house drainage and the materials used 2. Demonstrate the skills of constructing the various systems with supervision
Elements	1. Types of systems for plumbing drainage pipes: two pipes, one pipe, single stack and partially ventilated single stack systems Descriptions: two pipe system – one pipe for discharging urine, excreta and one for waste water; one pipe system - directly discharging all waste to main drain; single stack system - discharging soil and waste water into single pipe termed a soil cum waste pipe; partially ventilated single stack system - discharging soil and waste with a ventilated soil trap Materials: now mostly plastic but also pitch fibre, clay, uPVC, concrete, glass fibre reinforced plastics (GRP), iron and asbestos cement 2. Methods for plumbing, fitting, levelling and casting for the systems outlined above
Learning Strategies	1. In groups, discuss, describe and explain the plumbing systems used for house drainage and the materials used 2. Working in groups, practise the various methods of installing house drainage systems
Assessment	1. Written or oral explanation of the four plumbing systems used for house drainage and the materials used; make presentations in the class 2. Observation of the skills and methods practised in installing the four house drainage plumbing systems; evaluation of the quality of work

Plumbing And Pipe Fitting Modules	
S3	**Module 4: Drainage Below Ground**
Description	By the end of this unit learners will understand the types and composition of pipes used below ground and the tools used for the installation
Learning Outcomes	1. Understand the purposes of below ground drainage systems, the types and composition of pipes used, the materials required, the tools used and the methods of installation 2. Be able to lay below ground drainage systems
Elements	1. Purposes: used for conveying soil, waste water and storm water for final treatment or disposal Descriptions: underground house drain, inspection chamber, main drain or sewer, man-holes, ventilation shaft Composition: cast iron, reinforced concrete, pre-stressed concrete, mild steel, wrought iron, asbestos, polyvinyl chloride Tools and materials: pipe cutting tools, digging / trenching tools, shoring; pipes of appropriate size and composition, shingle Methods of joining: cement and lead 2. Practical work laying drainage systems
Learning Strategies	1. In groups, discuss drainage systems below ground; make presentations explaining purposes, descriptions, composition, tools, materials and methods of installation 2. Practise installing underground drainage systems
Assessment	1. Written or oral explanation of drainage below ground including purposes, descriptions, composition, tools, materials and methods of installation 2. Observation of the skills for installing of the drainage system below ground; evaluation of the quality of work

Plumbing And Pipe Fitting Modules	
S3	**Module 5: Sheet Metal Work (Sheet Lead Work) (2)**
Description	By the end of this unit learners will understand the use of sheet lead, how it is handled and used and the safety precautions adopted during the practice.
Learning Outcomes	1. Understand the term sheet lead and describe the methods involved in lead work including safety precautions 2. List and describe the types and sizes of sheet lead used by plumbers 3. Be able to apply the methods of working with sheet lead
Elements	1. Using lead: cutting, bending, rolling, jointing and curing (riveting, soldering and spot welding) Safety precautions: protective clothing, respiratory protection 2. Types and sizes: cast sheet lead and rolled sheet lead supplied as metal plate or coils in widths ranging from 150 – 600 mm; going up from 150 mm in steps of 30mm, i.e. 150, 180 etc; lengths: 3, 6 or 9 metres 3. Methods used in practice: bending, rolling, jointing and curing
Learning Strategies	1. In groups, discuss sheet lead and its uses; make a presentation in the class 2. In groups, discuss the types and sizes of sheet lead available to plumbers and the reasons for selecting each for different uses; make a presentation 3. Working in groups, practise the methods of working with sheet lead

SENIOR FOUR

Plumbing And Pipe Fitting Modules	
S4	**Module 1: Welding technology**
Description	By the end of this unit learners will understand the different types of welding, the tools, equipment, materials and methods used in welding and will be able to apply their skills in practice.
Learning Outcomes	1. Understand the meaning of the term welding, describe the different types of welding and the tools, equipment and materials used 2. Apply skills in the practice of welding
Elements	1. Description: welding is the only way of joining two or more pieces of metal by fusing them into a single piece. Types of welding: Oxyacetylene welding, manual metal arc welding, tungsten arc gas-shielded welding, metal arc gas shielded welding Tools and equipment: Power supply, consumable or non-consumable electrodes Materials: sheet lead, rolled sheet lead, welding rods, plastics, stainless steel, galvanized sheet, aluminium, copper 2. Practical application of welding skills
Learning Strategies	1. In groups, discuss the meaning of the term welding, the types of welding and the tools, equipment and types of materials used; make presentations in the class 2. Individually, practice the methods of welding using different types of materials
Assessment	1. Written or oral explanation of welding, the types of welding, the tools, equipment and materials used in welding 2. Observation of the skills applied in welding using different types of materials; evaluation of the quality of work

Plumbing And Pipe Fitting Modules	
S4	**Module 2: Plumbing Service Software**
Description	By the end of this unit learners will understand plumbing service software, its advantages, types of service software and how to use the software in practice.
Learning Outcomes	1. Understand the meaning of plumbing service software, its advantages and importance and the types available 2. Able to make use of plumbing service software in practice
Elements	1. Descriptions: plumbing service software provides an effective communication channel between customers and providers to improve effectiveness Advantages and importance: facilitates quicker response times; increases effectiveness, efficiency and revenues; facilitates effective scheduling; matches plumbing tasks to plumber's skills, part availability and location; creates useful reports on job data including total resource usage, service team's history and total time consumed Types of plumbing service software: QuickBooks service software, dispatch service software and scheduling service software 2. Practical application of plumbing service software
Learning Strategies	1. In groups, discuss the meaning of plumbing service software, the types available and the advantages of technology in running an effective and efficient plumbing service; make presentations in the class 2. Individually, practice using plumbing service software
Assessment	1. Written or oral explanation of plumbing service software, the types available and the benefits of using it 2. Observation of skills in making use of the software; evaluation of the quality of work

Plumbing And Pipe Fitting Modules	
S4	**Module 3: Traps**
Description	By the end of this unit learners will understand the purposes of a trap, the types of traps, the materials and the methods used for installation.
Learning Outcomes	1. Understand and describe the purpose of a trap, the types of trap and the materials used; outline the methods of installation 2. Be able to demonstrate the methods of installation of traps
Elements	1. Descriptions: a fitting provided in a drainage system to prevent foul air or gases from the sewer entering into the building Types and shapes: S-trap, P-trap and Q-trap, floor trap, gully trap, intercepting trap, grease trap, silt trap Materials used: cast iron pipe, concrete, traps, channel, bricks and mortar Methods of installation: S, P and Q shapes 2. Practical installation of each type
Learning Strategies	1. In groups, discuss the purposes of traps, trap types and shapes, the materials used and the methods of installation; make a presentation 2. Practice the methods of installing the different types of the traps
Assessment	1. Written or oral explanation of the importance of a traps, trap types and shapes, the materials used and the methods of installation 2. Observation of the skills for the installation of the traps; evaluation of the quality of work

Plumbing And Pipe Fitting Modules	
S4	**Module 4: Sewage Systems**
Description	By the end of this unit learners will understand the importance of sewage disposal, the types of sewage disposal facilities, and the materials and methods used in construction of sewage facilities.
Learning Outcomes	1. Understand the importance and reasons for sewage disposal 2. Describe the different disposal facilities and their operation: septic tank, soak pit, dispersion trench, sludge soak pit 3. Understand the materials and tools used for construction 4. Demonstrate skills of setting and constructing disposal facilities
Elements	1. Importance: eliminates large quantities of unstable organic matter which decays and emits offensive smells containing harmful bacteria which cause real danger to human life 2. Descriptions: **septic tank** - combined sedimentation cum tank in which flow of raw sewage is slowed down so that the solids settle down at bottom of the tank by sedimentation acted upon by bacteria and convert sewage to liquid and gaseous form; **soak pit** - function effectively when water table is sufficient below the ground level and the soil of porous type; **dispersion trench** - is an alternative method to septic tank, it dispose effluent from septic tank by soil absorption, conveying into small masonry distribution chambers through pipes; **sludge soak pit** - an alternative method of disposal of sewage from an individual house drain, can function effectively in situation where the ground water table is low and subsoil is of porous type 3. Materials used for construction: bricks, stones, sand, coarse aggregate, cement, reinforcement bars, stones, pipes, timber, nails, sheet metals; Tools: hammer, trowel, spirit level and builders square 4. Practical construction of disposal facilities
Learning Strategies	1. In groups, discuss the importance of disposing sewage and make presentations 2. In groups, discuss methods for disposing of sewage through septic tank, soak pit, dispersion trenches and sludge soak pit; make presentations 3. In groups, discuss methods of construction of disposal facilities and the materials used 4. Working in groups, practise constructing the different types of disposal facilities
Assessment	1. Written or oral explanation on the importance of disposing sewage 2. Written or oral explanation about the methods and their functions 3. Written or oral explanation of the methods of construction and the materials used 4. Observation of the skills in installing various types of disposal facilities; evaluation of the quality of work

Plumbing And Pipe Fitting Modules	
S4	**Module 5: Trenching Systems**
Description	By the end of this unit learners will understand trenching for pipelines, types of timbering of trenches suitable for different soil types and will be able to make trenches safely
Learning Outcomes	1. Understand and describe the meaning of and need for trenching and timbering to trenches 2. Describe the different types of soil, the implications for timbering of trenches and safe practice in trenching 3. Be able to put the methods of trenching and timbering into practice
Elements	1. Descriptions: Trenching is a technical term applied for digging a channel for a pipeline by hand or machine. Timbering to trenches: support to the sides of the trenches by placing temporary wooden boards and struts so as to avoid the earth falling back inside the trenches 2. Types of soils: hard soil, firm soil, moderately firm soil, loose and waterlogged soil; timbering needed for each Safety: protective clothing, not working alone in trenches, putting timbering in place while working to protect workers 3. Practical application of skills in digging and timbering trenches
Learning Strategies	1. In groups, discuss the purposes and methods of trenching and of timbering of trenches for pipelines; make a presentation 2. In groups, discuss soil types, the need to match timbering to soil properties, appropriate types of timbering for different soils and safe practice; make presentations 3. Working in groups, practise the methods of trenching and timbering in the different types of soil
Assessment	1. Written or oral explanation of the need for trenching for pipelines and for timbering of trenches 2. Written or oral explanation of the types of timbering for trenches in different types of soil 3. Observation of the skills in trenching and timbering trenches for pipelines, practising the safety rules; evaluation of the quality of work

Technical Drawing

Technical Drawing	
S1	**Module 1: Essentials of Technical Drawing**
Description	By the end of this module learners will be able to draw using different TD lines
Learning Outcomes	1. Define what is TD and understand its use 2. Name the 8 types of lines correctly 3. Be able to draw the 8 types of lines used in TD
Elements	1. TD is the act and discipline of composing drawings that visually communicate how something functions or is to be constructed. It is essential for communicating ideas in industry and engineering. 2. Thick, thin, thin continuous, irregular, thin short dashes, and thin chain line, chain (end and change of direction thick) 3. Practical application of learning in drawings
Learning Strategies	1. Explore and discuss the importance of technical drawing in everyday life, consider the need for TD professionals in different industries and businesses and present findings 2. Identify and name different types of lines use in range of professional drawings 3. Practice how to draw and name the different types of line
Assessment	1. Oral or written explanation of the importance of technical drawing as a language in engineering 2. Oral or written explanation of the 8 types of lines 3. Evaluation of quality of drawings of all 8 different lines used in technical drawing correctly named

Technical Drawing	
S1	**Module 2: Tools and Equipment**
Description	By the end of this module learners will be able to produce drawings using tools and equipment appropriately
Learning Outcomes	1. List tools and equipment for use for drawing 2. Explain the function of each item 3. Produce drawings using tools and equipment appropriately
Elements	1. Drawing board, T-square, compasses, dividers, protractors, drawing paper, pencil, rubber, ruler, set square, French curves 2. Accurate descriptions of function of each item 3. Apply learning in producing drawings of a range of objects using each item
Learning Strategies	1. Discuss different types of tool and equipment use in technical drawing 2. Discuss the use of each tools 3. Working in groups, learners familiarize themselves with each of these tools /pieces of equipment and individually produce drawings of a range of objects
Assessment	1&2. Written or oral explanation of tools and equipment used in technical drawing and their functions 3. Observation of skills in the use of each types of these tools; evaluation of the quality of drawings produced

Technical Drawing	
S1	**Module 3: Plane Geometry**
Description	By the end of this module learners will be able to divide lines and construct different angles
Learning Outcomes	1. Be able to accurately bisect a straight line and divide a line into number of equal parts 2. Be able to divide a line into a ratio of parts 3. Be able to construct different angles
Elements	1. Practical skills applied in dividing a line into 2, 4, 6, 5, 7 parts and explain how to apply technique to other divisions 2. Simple ratios: e.g. 2:1; 3:1; 4:3; Multiple ratios: eg 3:2:1 3. Construct a perpendicular (90o) to a given straight line, construct angles of 60o, 30o, 45o and copy a given angle
Learning Strategies	1. In groups, discuss methods of bisecting lines and practise performing accurately 2. In groups, discus the ratio method and practise performing accurately 3. In groups, explore methods of accurately constructing perpendiculars and angles, practise performing accurately
Assessment	1. Evaluation of quality of drawings of lines divided into 2, 4, 6, 5, 7 parts; oral or written explanation of how to apply the technique to other divisions 2. Evaluation of quality of drawings of lines divided into simple ratios: e.g. 2:1; 3:1; 4:3; and into multiple ratios: e.g. 3:2:1 3. Evaluation of quality of drawings of a perpendicular to a straight line, constructed angles of 60o, 30o, 45o and to copies of given angles

Technical Drawing	
S1	**Module 4: Triangles**
Description	By the end of this module learners will be able to identify and construct different types of triangle
Learning Outcomes	1. List different types of triangles and explain their properties, know the names of angles of different sizes 2. Construct the types of triangles
Elements	1. Classification by length of sides: equilateral, isosceles and scalene triangles; acute, obtuse and right angles 2. Construct triangles given: length of all sides; two sides and included angle; base, angle and height
Learning Strategies	1. In groups, think about different types of triangular shapes and how they can be classified. Find out and present a report showing the types, their names and the names of acute, right and obtuse angles. 2. Research and practise methods of drawing different types of triangles
Assessment	1. Written or oral explanation of different types of triangles, their properties and the names of angles of different sizes 2. Evaluate the quality of drawings of different types of triangles

Technical Drawing	
S1	**Module 5: Quadrilaterals**
Description	By the end of this module learners will be able to construct quadrilaterals
Learning Outcomes	1. State the meaning of quadrilaterals and name the types of quadrilaterals 2. Construct the types of quadrilateral and explain their uses in engineering work
Elements	1. Polygon with four edges (or sides) and four vertices or corners; square, rectangle, parallelogram, rhombus, trapezium, trapezoid 2. Construct all types; importance in engineering of using quadrilaterals in calculations relating to materials
Learning Strategies	1. Working in groups, identify different types of quadrilaterals, research their names and report conclusions to class 2. Research and practise methods of drawing different types of quadrilaterals and relate drawings to practical engineering when calculating materials
Assessment	1. Written or oral evidence of knowledge of the meaning of quadrilateral and the names of different types 2 . Evaluation of the quality of drawings of different quadrilaterals; written or oral explanation of the importance of calculations in working out materials required in engineering

Technical Drawing	
S1	**Module 6: Polygons**
Description	By the end of this module learners will be know and be able to construct various types of polygon.
Learning Outcomes	1. Define polygon and name the types of polygons 2. Construct various types of polygons 3. Explain how learning in relation to polygons is applied in practical situations in engineering
Elements	1. A shape with a number of straight sides; pentagon, hexagon, heptagon, nonagon, decagon 2. Construct each of the above polygons given the diameter of the circumscribing circle; regular hexagon given the distant across corners; regular heptagon given the length of one side; octagon given the length of one side 3. Uses in building and machinery
Learning Strategies	1. Work in groups to develop a definition of a polygon and match the different polygon shapes to their names 2. Research and practise methods of drawing different types of polygons, given the information listed in 2. above 3. Research how learning in relation to polygons is applied in practical situations in engineering and report to class
Assessment	1. Written or oral explanation of the definition and the different types of polygon 2. Evaluate quality of drawing of polygons 3. Written or oral explanation of the uses of polygons in engineering=

Year Two

Technical Drawing	
S2	**Module 1: Circles, Arcs, And Tangency**
Description	By the end of this module learners will be able to construct circles, arcs and tangents and relate these to their use in engineering
Learning Outcomes	1. Define circles, arcs and a tangent, and name the part of the circles 2. Draw circles, parallel lines, arcs and tangent with accuracy 3. Draw tangent to circles with different diameter; external and internally
Elements	1. Circle: closed curve on which every point is equally distant from a fixed point called the centre; arc: open curve, part of a circle; Tangent: a line which touches a circle or ellipse at just one point; Parts: circumference, diameter, radius, sector, chord, segment, arc 2. Draw circle, divide the circumference into 12 equal parts, inscribe, escribe and circumscribe in a given angle; draw arcs between lines meeting at angle of: 90o, more than 90o and less than 90o 3. Draw tangents to given circles from a given point outside it, external tangents to two equal circles and internal tangent to two equal circles
Learning Strategies	1. Discuss in groups familiar objects having circular shapes, explore the differences between arcs and tangents, research definitions of circle, arc and tangent and the parts of a circle; make a presentation 2&3. Practise drawing circles, arcs and tangents accurately
Assessment	1. Written or oral explanation of definitions of circle, arc, tangent, and the parts of a circle 2&3. Evaluation of quality of drawings of circles, arc and tangents

Technical Drawing	
S2	**Module 2: Loci**
Description	By the end of this module learners will be able to construct loci and relate their use to engineering works
Learning Outcomes	1. Define loci and list different loci 2. Construct loci and relate their use to engineering works
Elements	1. Loci: a set of points whose location satisfies or is determined by one or more specified conditions: ellipse, cycloid, epi-cycloid, hypo-cycloid, involutes, curves, Archimedean spiral and link mechanism. 2. Drawings of each of the above; examples to demonstrate importance of loci in engineering
Learning Strategies	1. In groups, investigate loci shapes relevant to daily life, produce a definition and a list of different loci 2. Practise constructing loci and produce a sequence of drawings different types of loci
Assessment	1. Written or oral explanation of definition and of different types of loci 2. Evaluation of quality of drawings of ellipse, cycloid, hypo-cycloid and epi-cycloid

Technical Drawing	
S2	**Module 3: Solid Geometry**
Description	By the end of this module learners will be able to construct drawings of geometrical shapes and relate them to engineering works.
Learning Outcomes	1. Define what solid geometry is and list the various type of geometrical shapes 2. Construct geometrical shapes and explain their uses in engineering
Elements	1. Geometry of three dimensional space; list: prism and pyramid of triangle, square, rectangle, pentagon, hexagon, cylinder 2. Construct each of the above; examples to demonstrate importance of solid geometry in engineering
Learning Strategies	1. Working in groups, find out the names and shapes of the range of three dimensional shapes listed above and report to class 2. Discuss and research how to produce drawings of solid geometry and practise drawing various engineering models
Assessment	1. Oral or written explanation of the meaning of solid geometry and of the range of 3D geometrical shapes 2. Evaluation of quality of drawings of different shapes of solid geometry

Technical Drawing	
S2	**Module 4: Symbols And Abbreviations**
Description	By the end of this module learners will be able to use the basic symbols and abbreviations correctly
Learning Outcomes	1. Be able to understand the symbols, the abbreviations and their importance in engineering 2. Use the symbols and abbreviations appropriately in drawing
Elements	Symbols: (a) **NEEDS DIAGRAMS** Symbols: (b) **NEEDS DIAGRAMS** Abbreviations **A/F** Across flat; **A/C** Across corner; **ASSY** Assembly; **CRS** Centres; **CL** center line; **CHAM** Chamfer; **CH HD** cheese head; **C'BORE** counter bore; **CYL** cylinder; **O/D** outside diameter; **ISO** internal organization for standard; **M/CD** machine; **Ø** diameter; **R** radius; **DRG** drawing; **HEX** hexagon; **EXH HD** hexagon head; **INT** internal; **LH** left hand; **NO** number; **PCD** pitch circle diameter; **RD HD** round head; **I/D** internal diameter; **SCR** screwed; **M/CY** Machinery; **SPHERE Ø** spherical diameter; **S'FACE** sport face; **SQ** or square; **STD** standard; **U' CUT** undercut; **M** meter; **MM** millimeter; **CM** centimeter; **TPI** thread per inch; **KG** kilogram; **MATL** material; **MAX** maximum
Learning Strategies	1. Research in groups the various engineering drawing symbols, the abbreviations, their meanings and their importance using a manual and other available resources; present findings to class 2. Practice drawing engineering drawings using symbols and abbreviations correctly
Assessment	1. Written or oral evidence of understanding of symbols, abbreviations and their importance 2. Evaluation of quality of drawings using these symbols and abbreviations

Secondary 3

Technical Drawing	
S3	**Module 1: Orthographic Projection**
Description	By the end of this module learners will be able to interpret and construct orthographic projection drawings (OPD).
Learning Outcomes	1. Understand the layout of orthographic projection on paper of various solid objects 2. Be able to locate the side view in relation to the direction of view in accordance to the rules of orthographic projection 3. Be able to demonstrate how to derive the scale for different drawings 4. Be able to produce a range of orthographic projection drawings including all of the required elements
Elements	1. Orthographic projection: vertical plane, horizontal projection and auxiliary vertical plane, layout of the orthographic projection on the drawing paper (the frame, title block, front view, plan and side view). 2. Locate: rules of first angle and third angle orthographic projections 3. Scale: full scale1:1, half scale 1:2, double scale 2:1, and others as considered appropriate by the teacher
Learning Strategies	1. In groups, consider the front view, side view, and plan view of a building and discuss how to interpret drawings and how to draw these views of a building; make a presentation to explain 2. In groups, discuss the rules of first angle, third angle and OPD and report on conclusions 3. In groups, work out how to use scale in technical drawings and report conclusions 4. Practise drawing OPDs as per the elements detailed above
Assessment	1. Written or oral explanation of orthographic projection and the layout of views 2. Written or oral evidence of the ability to locate the side view in relation to the direction of view 3&4. Evaluation of quality of drawings for both accuracy and correct use of scale

Technical Drawing	
S3	**Module 2: Dimensioning Of Engineering Drawing**
Description	By the end of this module learners will be able to construct dimension engineering drawings based on the unit used (metric or imperial)
Learning Outcomes	1. Know and be able to use metric and imperial units 2. Be able to give size to drawings by dimensioning in conformity to the rules dimensioning 3. Be able to apply appropriate dimensioning to engineering drawings
Elements	1. Metric units: millimeter, centimeter, meter; Imperial units: inches, feet 2. Dimensioning: (radii, diameter, angle, circle) designation of dimension.
Learning Strategies	1. In groups, discuss familiar types of dimensions; research and agree magnitude and relationship between different metric units and between different imperial units 2. Discuss methods of dimensioning objects and report to the class 3. Practise producing drawings, applying different types of dimensioning correctly
Assessment	1&2. Written or oral explanation of metric and imperial units and how they are used in dimensioning engineering drawings 3. Evaluate the quality of display of the dimensions in drawings of the following: radius, diameter, angles and circles

Technical Drawing	
S3	**Module 3: Isometric Projection**
Description	By the end of this module learners will be able to draw isometric axes and distribute the dimensions appropriately.
Learning Outcomes	1. Understand the meaning of isometric projection; be able to draw isometric axes correctly 2. Be able to make isometric projections using drawing instruments 3. Be able to make isometric projection of a given figure and of objects and add dimensions
Elements	1. Isometric axes: horizontal line, incline line 30o and vertical 90o 2. Drawing instruments: ruler, compass, protractor, set square 30o and pencil 3. Isometric projections, including dimensions, of: cube, triangular prism, right cylinder, right hexagonal prism, pyramid, cone and frustum.
Learning Strategies	1. In groups, research and discuss isometric projections and their uses and identify the types of isometric axes; make a presentation 2. Explore how isometric projections are drawn and how each instrument is used; produce a report to the class 3. Practise drawing isometric projections of different types of objects (as in elements list), adding dimensions
Assessment	1. Written or oral explanation of isometric axes and isometric projection and its uses 2. Written or oral explanation or practical demonstration of how the different drawing instruments are used 3. Evaluate quality of drawings of isometric projections and dimensioning

Technical Drawing	
S3	**Module 4: Oblique Projection**
Description	By the end of this module learners will be able to identify the difference between oblique and isometric projection and determine the true shape of components from drawings
Learning Outcomes	1. Explain the differences between isometric and oblique projections 2. Be able to draw oblique axes for different receding angles 3. Be able to make an oblique projection of a v-block and other objects decided by the teacher 4. Be able to interpret true shapes from projections
Elements	1. Both forms of graphical projection, methods of visually representing three-dimensional objects in two dimensions; isometric: three co-ordinates appear equally foreshortened; Oblique: parallel lines in the object appear as parallel lines in the projected image. 2. Draw using receding angles 30o, 45o and 60o 3. V-block and other objects decided by the teacher
Learning Strategies	1. In groups, using a range of models and drawings, compare isometric and oblique projections, deduce differences and present findings 2. Discuss in groups the features of oblique projections, work out how they are drawn and practice drawings of oblique axes for different receding angles 3. Practise drawing oblique projections of a v block and other shapes; 4. Practise working out what a true shape is from a projection
Assessment	1. Written or oral explanation of the difference between isometric and oblique projections 2. Evaluation of drawings of oblique axes for different receding angles 3. Evaluation of drawings of oblique projection of a v-block and other objects decided 4. Written or oral explanation of true shapes from projections

Technical Drawing	
S3	**Module 5: Sectioning**
Description	By the end of this module learners will be able to use sectional drawings to clarify internal detail of an object and use sectional lines appropriately
Learning Outcomes	1. Be able to interpret sectional drawings 2. Be able to apply the rules of sectioning when drawing 3. Be able to cross hatch correctly (with 45o angle lines, approximately 4mm apart) 4. Be able to identify sectioning exceptions
Elements	1. Read: cutting plane, hidden details 2. Draw component and across hatch 3. Rules of sectioning: single parts, two adjacent part, more than two adjacent parts and symmetrical part 4. Sectioning exceptions: nuts and bolts, studs shafts, webs, keys, pins, gear teeth, and rivets
Learning Strategies	1. In groups, discuss sectioning in engineering components to identify what it means and why it is needed; report conclusions 2. Discuss in groups the rules followed in sectioning and the reasons for them; practice drawings with sectioning, applying the rules correctly 3. Practice cross hatching with 45o angle lines, approximately 4mm part 4. In groups, examine drawings with sectioning exceptions and devise rules for when exceptions apply (ie when hatching is not used)
Assessment	1. Written or oral interpretation of a range of sectional drawings 2. Evaluation of quality of drawings, with rules of sectioning applied correctly 3. Evaluation of quality of cross-hatching (45o angle lines and approximately 4mm apart) 4. Written or oral explanation of sectioning exceptions

Year 4

Technical Drawing	
S4	**Module 1: Free Hand Sketching**
Description	By the end of this module learners will be able to sketch (pencil) engineering components without the use of drawing instruments
Learning Outcomes	1. Understand the differences between a sketch and a scale drawing and the need for sketching 2. Be able to sketch to a good standard 3. Complete an isometric sketch of a component of a machine (e.g. connecting rod in motor car engine) to a good standard
Elements	1. Technique of sketching: use grid paper sketch isometric circle, pencil 2. Isometric sketch of a connecting rod in a motor car engine and other components as selected by the teacher
Learning Strategies	1. Compare a free hand sketch and a scale drawing, find and describe the differences and discuss in groups the need for free hand sketches. 2. Practise sketching a range of objects 3. Draw a good quality free hand sketch of the selected component
Assessment	1. Oral or written explanation of the differences and the need for free hand sketches 2&3. Observation of sketching skills and evaluation of the quality of free hand sketch of the selected component

Technical Drawing	
S4	**Module 2: Fasteners (Mechanical only)**
Description	By the end of this module learners will be able to select appropriate methods to join (secure) engineering components and make isometric projections of them
Learning Outcomes	1. Describe the two classes of fastening and identify different type of fasteners 2. Understand the terms used in screw threads 3. Draw different types of fasteners in isometric projection to a good standard
Elements	1. Two classes of fastening: temporary and permanent fastening; Types of fasteners: bolts and nuts, screws, studs, taper pins, split pins, cotter pins, circlips, rivets and welding 2. Terms used in screw threads: pitch, lead, internal and external thread, effective diameter or pitch diameter 3. Different types of fasteners in isometric projection including front, plan and side views of bolt and nut
Learning Strategies	1. Discuss and research different classes and types of fasteners used in engineering applications and their importance and present a report to the class 2. In pairs or groups, research terms used in screw threads and present a report 3. Practice drawing isometric projections of different types of fasteners
Assessment	1. Written or oral explanation of the classes and different types of fasteners 2. Written or oral explanation of terms used in screw threads 3. Evaluation of quality of drawings of different types of fasteners

Technical Drawing	
S4	**Module 3: Interpenetration Of Solids**
Description	By the end of this module learners will be able to trace and draw the exact point of intersection of two objects
Learning Outcomes	1. Understand the meaning of interpenetration and intersection of similar and dissimilar objects and be able to give examples 2. To be able to accurately draw the intersection of similar objects 3. To be able to accurately draw the intersection of dissimilar objects
Elements	1. Interpenetration of solids when one solid penetrates another and so their surfaces intersect; examples such as those in 2. & 3. 2. Interpenetration of similar object such as: two equal cylinders, two equal hexes, prism and others 3. Interpenetration of dissimilar objects such as: two unequal cylinders, two dissimilar square prisms meeting at right angles such as: a square pyramid and hexagon prism meeting at right angle
Learning Strategies	1. Work in groups, think about similar and dissimilar objects that interpenetrate and make a presentation of examples 2. Practise drawing interpenetration of similar objects 3. Practise drawing interpenetration of dissimilar objects
Assessment	1. Written or oral explanation of the meaning of interpenetration of similar and dissimilar objects and a range of correct examples 2&3. Evaluation of the quality of the drawings of interpenetration of similar and dissimilar objects

Technical Drawing	
S4	**Module 4: Development Of Surface**
Description	By the end of this module learners will be able to visualize, calculate and accurately draw surface development of engineering components
Learning Outcomes	1. Be able to explain surface development 2. Be able to list objects made by surface development 3. Be able to draw the surface development of solid components
Elements	1. Surface development: folding, unfolding 2. Objects made by surface development: square prism with oblique top, cylinder with oblique top and cylinder 3. Draw the surface development of: square prism with oblique top, cylinder with oblique top, cylinder
Learning Strategies	1&2. Work in groups and investigate the meaning of surface development, research objects made by surface development and make a presentation 3. Practice developing solid components
Assessment	1&2. Oral and written explanation of surface development and objects made by surface development 3. Evaluate the quality of surface development of solid objects

Technical Drawing	
S4	**Module 5: Further Problems In Orthographic Projection**
Description	By the end of this module learners will be able to read assembly drawings, design simple items and incorporate other concepts covered earlier into their work.
Learning Outcomes	1. Be able to read and understand an orthographic projection of complex parts 2. Be able to make an orthographic projection from an isometric projection of simple machine parts (drawn from orthographic projection) and vice versa 3. Be able to deduce missing lines and view from a given view 4. Be able to design simple articles for further problems
Elements	1. Complex part: tools rest, operating linkage, exhaust pipe gasket, valve assembly 2. Machine part: angle bracket v-block, footstep–bearing, end plate. 3. Missing line: projection line 4. Simple articles: shovels, exhaust pipe gaskets, others to be added by the teacher.
Learning Strategies	1. In groups, research orthographic projection of complex parts using a range of suitable resources and references 2. Work in groups on how to make orthographic projection from isometric projection and vice versa; present a report 3. In groups, investigate how to deduce missing lines and different views 4. Practise drawing simple articles
Assessment	1. Written or oral explanation of how to interpret orthographic projection of complex parts 2. Evaluation of the quality of drawings both when drawing orthographic projection from isometric projection and vice versa 3. Written or oral explanation of how to deduce and draw missing lines and different views from given points 4. Evaluation of quality of drawings of simples articles elected by the teacher

Technical Drawing	
S4	**Module 6: Building Plans (Civil Engineering only)**
Description	By the end of this module learners will understand and be able to interpret building plans and working drawings
Learning Outcomes	1. Be able to identify, understand and interpret a building plan, a working drawing and a specification including symbols used 2. Accurately draw a plan of a rectangular building and write its specification
Elements	1. Definitions: building plan, working drawing, specification; Interpret: dimension of the site and building, bearing capacity of the soil, ground settlement, size of foundation, depth and width of the foundation, size of the windows and doors, thickness of the walls, section of the building and elevation Symbols: mass concrete, reinforcement concrete, cement and sand screed, earth, hard core, membrane; specification: brick work section, cavity wall section, block work section, stone section 2. For example, a building of size: 12.5m x 7.8m to scale of 1:100 and list specifications on it correctly
Learning Strategies	1. In groups, research conventions and symbols used in building plans, working drawings and specifications and write a report; discuss a building plan, a working drawing and a specification and give a presentation, incorporating all the elements in 1 above in the plan and the drawings 2. Practise drawing a plan for a rectangular building, using symbols correctly and writing a specification
Assessment	1. Written explanation of how building plans and working drawings are drawn, of the symbols that are used and of how the specification for a project is drawn up 2. Evaluation of quality of drawing of rectangular building and its specifications

Technical Drawing	
S4	**Module 7: Bill Of Quantity (Civil Engineering only)**
Description	By the end of this module learners will understand the difference between a bill of quantity and a specification and write a bill of quantity, following the correct procedure
Learning Outcomes	1. Be able to define what a bill of quantity is and understand the difference between this and a specification 2. Be able to identify the types and quantities of materials needed for the building according to the specification 3. Be able to write the bill of quantity and follow the correct procedure
Elements	1. Definitions: bill of quantity lists material, amount, cost; specification describes the standard of workmanship and material required for a particular building 2. Interpretation of a specification or more than one example 3. Follow procedure working from specification: description, unit, quantity, rate and amount
Learning Strategies	1. Work in groups to explore the difference between a bill of quantity and a specification and report to class 2. Find out from a range of sources the types of materials required for a building with respect to specifications and feed back 3. Practice producing a written bill of quantity and specification for a selected scheme and ensuring they are consistent
Assessment	1. Written or oral explanation of the difference between a bill of quantity and a specification 2. Written explanation of the type and quantity of materials needed for a building according to its specification 3. Written preparation of a bill of quantity and specification for a selected project

Welding

Welding	
S1	**Module 1: Bench work**
Description	By the end of this module the learners will be able to carry out bench work using a range of tools and machines and make a simple object using these tools.
Learning Outcomes	1. Know and understand how to use a bench 2. Practice using a range of tools in bench work 3. Make a simple product
Elements	Vice, files, tape, chisel, hammer, tap, die, drill, drill bits, try square, steel ruler, surface gauge, micrometer, dial indicator, hack saw, rivet gun, surface plate etc
Learning Strategies	1. Be shown how to use a bench and bench work tools. 2. As a group write simple instructions on using a bench and bench equipment and tools. 3. Be given a range of simple objects to make that will require bench work and uses of a range of tools. 4. Make a simple product
Assessment	1. & 2. Use of bench and tools appropriately, and correctly written instructions on how to use a bench 3. Final product: a sample of three simple objects. This could be a nut, a bolt, a try square etc

Welding	
S1	**Module 2: Health and Safety**
Description	By the end of this module the learners will know how to work safely in the workshop, know basic first aid and understand how to use a fire extinguisher
Learning Outcomes	1. Understand and use welding and other equipment safely 2. Use tools and protective clothing appropriately 3. Understand how to handle and use electrical equipment safely 4. Understand the causes of failure of tools and machines 5. Know how to perform basic first aid. 6. Understand how to use different fire extinguishers for different types of fire.
Elements	Goggles, safety boot, helmet, overalls, welding glasses, welding tools, safety for electrical equipment, when lifting, using hand tools and machine tools, potential causes of fire, rotating equipment, operating a fire extinguisher, performing basic first aid. Different fire extinguishers, Class A, Class B and Class C
Learning Strategies	1.Be shown how to use equipment and tools safely, and the use of appropriate protective clothing e.g. grinding and cutting machines Discuss in groups the importance of workshop safely and write safety instructions for use in the workshop. 2.Practise using the welding machine, wearing appropriate protective clothing. 3. Be shown and practise insulating electrical wires. Be shown and practice operating the cut out switches. 4. Be shown the impact of a faulty machine or tool 5. role play first aid scenarios 6.Be shown the use of different fire extinguishers and discuss their different uses. Practice use of soil and water to extinguish Class A and a Class B fires
Assessment	1. Use welding and other equipment safely 2. Use tools and protective clothing appropriately 3. Use electrical equipment safely 4. Oral or written explanation of the causes of tool and machine failures 5. Demonstrate appropriate knowledge and understanding when performing basic first aid in role play 6. Written or oral explanation of the different types of fires and extinguishers. Use of simple soil and water fire extinguishers appropriately to successfully extinguish a fire

Welding	
S1	**Module 2: Health and Safety**
Description	By the end of this module the learners will know how to work safely in the workshop, know basic first aid and understand how to use a fire extinguisher
Learning Outcomes	1. Understand and use welding and other equipment safely 2. Use tools and protective clothing appropriately 3. Understand how to handle and use electrical equipment safely 4. Understand the causes of failure of tools and machines 5. Know how to perform basic first aid. 6. Understand how to use different fire extinguishers for different types of fire.
Elements	Goggles, safety boot, helmet, overalls, welding glasses, welding tools, safety for electrical equipment, when lifting, using hand tools and machine tools, potential causes of fire, rotating equipment, operating a fire extinguisher, performing basic first aid. Different fire extinguishers, Class A, Class B and Class C
Learning Strategies	1.Be shown how to use equipment and tools safely, and the use of appropriate protective clothing e.g. grinding and cutting machines Discuss in groups the importance of workshop safely and write safety instructions for use in the workshop. 2.Practise using the welding machine, wearing appropriate protective clothing. 3. Be shown and practise insulating electrical wires. Be shown and practice operating the cut out switches. 4. Be shown the impact of a faulty machine or tool 5. role play first aid scenarios 6.Be shown the use of different fire extinguishers and discuss their different uses. Practice use of soil and water to extinguish Class A and a Class B fires
Assessment	1. Use welding and other equipment safely 2. Use tools and protective clothing appropriately 3. Use electrical equipment safely 4. Oral or written explanation of the causes of tool and machine failures 5. Demonstrate appropriate knowledge and understanding when performing basic first aid in role play 6. Written or oral explanation of the different types of fires and extinguishers. Use of simple soil and water fire extinguishers appropriately to successfully extinguish a fire

Welding	
S1	**Module 3: Workshop calculation**
Description	By the end of this unit the learner should be able to carry out and make use of basic mathematical calculations in the workshop
Learning Outcomes	1. Understand how to perform arc welding based on calculation 2. Understand how to calculate the quantity of material needed for a product 3. Know how to use calculations in the production of a product eg marking 4. Understand and know how to measure accurately
Elements	Arc welding calculations and dimensions, amps, thicknesses, basic mathematical operations, area, perimeter, capacity and volume Measuring and marking eg sheet metal, angle bars, hollow sections and other materials
Learning Strategies	1. Be shown how to calculate for arc wielding, cutting and drilling. In groups, calculate the settings needed for different thickness of a material, and then test these calculation by using the machines 2. In groups, find out the quantity of materials needed for a given product 3. & 4 Practice measuring and marking eg sheet metal, angle bars, hollow sections and other materials
Assessment	1. Written or oral explanation of how to calculate for arc welding 2. Written calculations for the production of a product 3. & 4 Measuring and marking accurately in a range of situations such as those given as examples in the elements

Welding	
S1	**Module 4: Welding equipment and tools**
Description	By the end of this unit the learner should be able to identify and use welding tools and equipment and know its application in the workplace
Learning Outcomes	1. Understand the differences in welding machines and tools, and their application in the workplace 2. Able to use welding machines and tools appropriately 3. Starting the arc and maintain burning
Elements	Welding machine, welding shield/helmet, chipping hammer, wire brush, electrode holder, earth clamp, cable, work piece etc.
Learning Strategies	1. In groups handle welding tools and equipment and learn about their uses. Make a poster illustrating this. In groups, research the different types of welding machines and their uses in the work place. 2. Practise starting the arc and keeping it burning 3. Practise flat welding, vertical welding horizontal welding overhead welding, using appropriate tools and welding machine.
Assessment	1.Written or oral explanation of the differences in welding machines and tools, and uses in the workplace 2. Starting the arc and maintaining the burn in the four positions 3. Using welding machine and tools appropriately

Welding	
S2	**Module 1: Material Science**
Description	By the end of this unit the learner should be able to understand engineering materials and the principles of heat treatment of metal, and identify different materials correctly.
Learning Outcomes	1.Know the properties of metals and understand their use in welding 2. Understand the changes that metal undergoes when heated 3. Understand the differences between ferrous metal and non-ferrous metal
Elements	Range of metals, elasticity, plasticity, malleability, ductility, , toughness, sheer strength, tensile strength, conductivity, corrosion, resistance, annealing, normalizing, tempering, hardening
Learning Strategies	1. Investigate the properties of a range of materials eg mild steel, cast iron, aluminum, copper, plastic etc 1. In groups research the application of metals in welding and make a presentation to the class. 2. Be shown the impact of heat on metal. In a group practise heating metal and make observations of the effect of heat on metal 3. In pairs research and then make a table to show the differences between ferrous metal and non-ferrous metal
Assessment	1. Written or oral explanation about the properties of metal and their uses in welding 2.Written or oral explanation of the changes that metal undergoes when heated 3. Accurate table that illustrates the difference between non ferrous and ferrous metal

Welding	
S2	**Module 2: Essentials of welding**
Description	By the end of this unit the learner should be able to carry out welding techniques in various applications and positions and produce a product
Learning Outcomes	1. Understand the different types of joints and their uses. 2. Make a number of different joints 3. Carry out positional welding using various beads 4. Make a repair 5. Make a product
Elements	Corner joint, T Join, lap joint etc. flat welding, vertical welding horizontal welding overhead welding, beads. Repair work: preparation.
Learning Strategies	1. Be shown the different types of joints and in groups discuss their uses. 2. Practise making different joints. In groups discuss what was easy and what was difficult. 3. Practise positional welding using different joints and beads 4. Be told different, and if possible shown video pictures of, different repairs. Practise repairs 5. Use the above joints and welding positions to make several simple objects.
Assessment	1.Written or oral explanation of the different types of joints and their appropriate uses 3. Positional welding using appropriate beads 4. Repair is successful 2 &5. A product which demonstrates use of appropriate joints and beads. It should have more than one type of joint. This might be a window, a door, roof trusses

Welding	
S2	**Module 3: Hand Forging**
Description	By the end of this unit the learner should know and be able to use the tools and equipment used in hand forging to design and produce a simple tool, and understand the use of decorative work.
Learning Outcomes	1. Know and understand the use of hand forging tools and equipment 2. Identify the forging metals and know that some metals are not suitable for hand forging 3. Understand that the hand forging process may be different because different products require different metals according to their use 4. Know the working heat for various metals 5. Use hand forging to produce a simple tool 6. Know where decorative work is used and make a sample using decorative work
Elements	Tools and equipment used in hand forging, hand forging metals – mild steel, wrought iron, aluminum (malleable metals) metals that cannot be forged for example, steel (non malleable metals) Hand forging process, working heats. Decorative work
Learning Strategies	1.Be shown and examine tools made by hand forging and discuss their design and use. 2. Investigate metals to find out which ones are suitable for hand forging. Present the findings to the class 3. Be shown and told that the processes for hand forging depend on the metal used and the product required. 4. Be told the working heat for various metal. Use a forge to heat metal to required temperature In a group discuss various hand forging tools and equipment 5. Use hand forging to design and make a simple tool 6. Research the uses of decorative work Make a decorative piece to their own design
Assessment	1.Written or oral explanation of the uses of hand forging tools and equipment 2. Investigation into metals that can be forged and those which cannot 3. Hand forging that demonstrates different processes according to the metal used 4. Written or oral explanation of the working heat of various metals 5. A simple tool. This might be tongs, a gate hinge or a pick axe 6. A decorative sample of work that is well made and fit for purpose

Welding	
S2	**Module 4: Sheet metal work**
Description	By the end of this unit the learner should be able to understand sheet metal work and apply this to design and make an object
Learning Outcomes	1.Explain the principles of working with sheet metal 2. Design and make a product as a group
Elements	Objects made with sheet metal including silos. These could be pictures, photographs but preferably actual objects or a mixture of all three. Tools: Tin man snips, tin man's mallet, hammers, forming tools. Joints: lap joints, creased joints, folded seam, grooved seam, box seam, circular lapped seam, circular papped joint, circular folded seam.
Learning Strategies	1. In groups practice work with sheet metal and then discuss the advantages and disadvantages of using sheet metal. Make a table to illustrate this. 2. In groups design and make a suitable product for example a small silo
Assessment	1.Oral or written explanation of the principles of working with sheet metal. Demonstrate understanding of principles working with sheet metal, by marking out, bending, cutting and joining appropriately 2. A product which has suitable joints, rivets and uses bending technique

Welding	
S3	**Module 1: Gas welding**
Description	By the end of this unit the learner should be able to carry out gas welding procedures
Learning Outcomes	1.Use gas welding in a range of situations appropriately 2. Assemble and disassemble gas welding set 3.Understand that gas welding uses the same techniques as arc welding 4.Know that gas is used for welding and cutting /gouging 5.Know the difference between gas welding and other types of welding 6.Know the Health& Safety regulations for gas welding 7.Know the different types of flames and how to set them
Elements	Acetylene, oxygen, hose pipes, welding torch, cutting torch, filler wires, fluxes, pressure regulator, gas lighter, gas welding goggles, beads and positional welding , safety and health for gas welding etc
Learning Strategies	6.Be told the specific safety requirements for gas welding. 2. Be shown how to assemble the gas welding set and practice this 1& 3 4 Practice gas welding in a range of situations and using different tools and materials 5.In groups, explore the differences and similarities between gas and other types of welding and produce a table to illustrate this. 7. Be told the different types of flame and settings. In groups practice this
Assessment	1.Written or oral explanation and use of gas welding in a range of situations 2. Assemble and disassemble gas welding set appropriately 3. Written or oral explanation of the technique used in arc and gas welding 4.Written or oral explanation to illustrate the techniques of gas welding. Cut or gouge a given piece of blank/material 5. A table to show the difference between gas and other types of welding 6. Written or oral explanation on relevant safety and health in gas welding 7. Lighting and setting different types of gas flames effectively

Welding	
S3	**Module 2: Machine tools**
Description	By the end of this unit the learner will understand the different types of machines for different purposes
Learning Outcomes	1.Understand the function and operation of a range of different machines 2. Know how to operate a number of different machines and know their different functions 3. Understand the sequence of production
Elements	Different machines eg power hacksaw, bench drilling machine, pedestal grinder, shearing machine, roller bender, angle grinder etc. Draw, mark out, cut, drill if required, file and assemble, appropriate heat treatment.
Learning Strategies	1. In groups research the different machines for different purposes and their functions. 3. In groups design an appropriate sequence of production for a given job/product 1 & 2. Use machines to carry out a process eg drilling, grinding etc
Assessment	1. Written or oral explanation on the operation of the above machines 2. Use the machine tools mentioned in the elements to perform a process appropriately eg drilling, filing, grinding 3. Write a sequence of production for three products; a steel door, a measuring tool holder, a bottle opener etc

Welding	
S3	**Module 3: Difficulties and defects in welding**
Description	By the end of this unit the learner should understand the problems associated with arc and gas welding, understand the defects that can occur and know how to correct them
Learning Outcomes	1. Identify a range of defects associated with arc and gas welding 2. Know the possible causes of the defects 3. Reconise and know how to correct defects 4. Understand how to weld without creating defects
Elements	Defects: Incomplete penetration, poor appearance, undercut, excessive spatter, arc blow, cracked weld, distortion and warping, slug inclusion, brittle welt. Causes of defects: low current/nozzle size, long arc length, high current/nozzle too large/arc blow, welding speed too high, very low welding speed, rust on the material.
Learning Strategies	1. Be shown the various defects in both gas and arc welding 2. Be shown how the defects occur, if possible using video. Produce a piece of welding 3. In a table show the various defects and their possible remedies
Assessment	1.Written or oral explanation on the defects in arc and gas welding as listed in the elements 2.Written or oral explanation on the possible causes and possible solutions for the defects in the elements 3.Welding that does not have defects

Welding	
S3	**Module 4 Electrodes for manual metal arc welding**
Description	By the end of this unit the learner should be able to use electrodes appropriately
Learning Outcomes	1.Understand that different electrode types are used for different purposes 2. Understand how to set welding current depending on electrode size and metal thickness 3. Know the properties of electrode coating (flux covering) and understand its importance
Elements	Electrode types: Mild steel, cast iron, stainless steel, aluminium , Electrode sizes: 1.5mm, 2.5mm, 3.2mm, 4mm, 6mm
Learning Strategies	1.In groups identify various electrodes according to their materials and diameter. Practice welding with the electrodes listed in the elements 2. In groups practice setting welding currents for various electrode sizes 3.In groups discuss the properties and importance of electrode coating
Assessment	1.Written or oral explanation on the use of different electrodes on different materials 2.Setting welding currents appropriately according to electrode size and thickness of material 3.Written or oral explanation on the properties of electrode flux covering and their importance

Welding	
S4	**Module 1 Production and fabrications**
Description	In this module the learner will use the skills developed over the course to design and make a product using welding
Learning Outcomes	1. Design and make a drawing for a product 2. Calculate the quantities needed for a product 3. Understand and calculate how to join materials of different thickness and metals 4. Know how to make a simple bill of quantities 5. Understand the importance of design 6. Make a product using their own design
Elements	Simple products: Windows, doors, table, hinges, tore bolts, Join metals using appropriate methods Bill of quantity, joining materials of different thickness
Learning Strategies	1 and 5. Discuss the design of products listed in the elements. 2. Be shown how to calculate quantities needed for a product and in groups calculate the quantities needed for the products listed in the elements 4. Be shown how to make a bill of quantities and in groups practice this using the products in the elements 3.Be shown how to calculate how to join materials of different thickness and practise this using the machines In groups work together to calculate for and design a product
Assessment	1- 6. A completed product based on learner's own design

Welding	
S4	**Module 2 Foundry work**
Description	By the end of this unit the learner should be able to carry out casting work using a range of materials and including decorative work.
Learning Outcomes	1. Know the procedures for making a casting 2. Identify casting tools and equipment 3. Produce products using the casting process 4. Understand how decorative work is used and produce samples or blanks 5. Make a product using decorative work
Elements	Tools and equipment: moulding boxes patterns, English trowel, broad heart trowel, Scotch trowel, long heart trowel, heart and square, gate knife, taper trowel. Manner of casting, moulding, foundry sand, green moulding, moulding procedures. Decorative work
Learning Strategies	2. Be shown how to use tools and equipment correctly 2. Practice the use of the different tools and equipment. 1. Be told/shown the procedure for making a casting 3. In groups design and produce a pattern and use this to produce a casting from the pattern 5. In groups research the different types of decorative work and its application in the workplace. 6. In groups design a product using decorative work
Assessment	1. Written or oral explanation of the procedure for making a casting 2. Practically select the tools mentioned in the elements from a range of display 3. An accurate product using the casting process. 4.&5. A product using decorative work

Vocational Programme Overviews

South Sudan