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Commissioner for Education

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

WELDING AND METAL FABRICATION SYLLABUS FOR ORDINARY SECONDARY EDUCATION VOCATIONAL STREAM FORM I-IV

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Abbreviations and Acronyms

CBET	Competence Based Education and Training
CBA	Competence Based Assessment
CBET	Competence Based Education and Training
CBA	Competence Based Assessment
DT	Destructive Test
MAG	Metal Active Gas
MIG	Metal Inert Gas
TDS	Tap Drill Size
TIG	Tungsten Inert Gas
WF	Welding and Metal Fabrication

Definition of Key Terms

Assessment: The process of collecting evidence and making judgments on whether competency has been achieved, or whether specific skills and knowledge have been achieved that will lead to the attainment of competency.

Circumstantial knowledge: Detailed knowledge, which allows the decision-making in regard to different circumstances and cross cutting issues.

Competence: The ability to use knowledge, understanding, practical and thinking skills to perform effectively to the workplace standards required in employment.

Element: A sub- unit (step), which reflects learning sequence with the aim of achieving broad learning objectives of a unit.

Performance criteria: An indication of the expected end results or outcome in form of evaluative statements.
Standard: A set of statements, which if proved true under working conditions, means that an individual is meeting an expected level and type of performance.

Unit: A statement of broad learning objectives, which prescribe the requirements of a standard in form of practical skills, knowledge and appropriate attitudes.

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For and on behalf of:
Vocational Education and Training Authority

CPA (T) Anthony M. Kasore
Director General

1.0. Introduction

Welding and Metal Fabrication is one of the occupations taught in the Ordinary Secondary Education Vocational Stream. In Tanzania, there is a growing demand for skilled professionals in the metal working industry, as metal products are essential in construction, machinery, and many other sectors. Teaching Welding and Metal Fabrication enables students develop the necessary skills to shape, join, and fabricate metal materials into useful products. This field supports both local industries and the economy by reducing the reliance on imported metal goods. Moreover, the skills gained in this field promote job creation, contribute to economic growth, and support the sustainable use of local resources.

Upon completing the program, students will acquire both theoretical and practical knowledge in welding and metal fabrication. They will be proficient in identifying suitable metals, operating specialized equipment, and executing complex tasks with precision. Emphasis is placed on workshop safety, adherence to environmental standards, and the application of sustainable practices. Students will also develop entrepreneurial skills to establish and manage welding and fabrication enterprises, ensuring high standards of innovation and quality in their work.

Graduates in this occupation can pursue their careers in both the public and private sectors. Potential employers include Government departments, construction companies, industrial plants, research and training institutions, and non-governmental organizations (NGOs). Additionally, graduates can explore opportunities in self-employment, by managing their own welding and metal fabrication ventures, or working in small, medium, and large-scale industries.

The Welding and Metal Fabrication Syllabus has been developed to guide the teaching and learning of this subject in the Ordinary Secondary Education Vocational Stream. It outlines the competences that students should develop and it also provides essential information for teachers to effectively plan their lessons; ensuring students acquire the skills needed to excel in this field.

2.0. Main Objectives of Education in Tanzania

The main objectives of education in Tanzania are to enable every Tanzanian to:

(a) Develop and improve his or her personality so that he or she values himself or herself and develops self-confidence;

(b) Respect the culture, traditions, norms and customs of Tanzania, cultural differences, dignity, human rights, attitudes and inclusive actions;

(c) Advance knowledge and apply science and technology, creativity, critical thinking, innovation, cooperation, communication and positive attitudes for his or her own development and the sustainable development of the nation and the world at large;

(d) Understand and protect national values, including dignity, patriotism, integrity, unity, transparency, honesty, accountability and the national language;

(e) develop life and work-related skills to increase efficiency in everyday life;

(f) Develop a habit of loving and valuing work to increase productivity and efficiency in

production and service provision;

(g) Identify and consider cross-cutting issues, including the health and well-being of the society, gender equality, as well as the management and sustainable conservation of the environment; and

(h) Develop national and international cooperation, peace and justice per the Constitution of the United Republic of Tanzania and international conventions.

3.0. General Competencies for Ordinary Secondary Education Vocational Stream

The general competences for Ordinary Secondary Education, Form 1–IV, Vocational Education stream are to:

(a) Apply the knowledge, skills and attitudes the student developed in the primary school stage to increase his/her understanding of technical skills;

(b) Apply technical skills in designing, inventing and making various things to cope with life and solve challenges in society, including cross cutting issues;

(c) Appreciate citizenship and national virtues;

(d) Use language skills;

(e) Demonstrate self-confidence in learning in various fields, including science and technology, technical knowledge and technical skills;

(f) Appreciate procedures and safety rules in using technical tools correctly; and

(g) Apply the technical knowledge and skills acquired to develop oneself with vocational and technical education and join the workforce.

4.0. General Competences of the Occupation

Upon completion of this occupation, students are expected to have ability to:

(a) Maintain health and safety at place of work;

(b) Fabricate, Install steel structures and sheet metals;

(c) Cut and Join different metals by fusion and non-fusion methods;

(d) Inspect and rectify weld defects;

(e) Maintain and service equipment, machines and tools;

(f) Maintain materials stock levels;

(g) Supervise junior staff; and manage workshop.

5.0. Main and Specific Competences

The main and specific competences to be developed are presented in Table 1

Table 1: *Main and Specific Competences for Form I-IV*

Main competences		**Specific competences**
1.0	Maintaining Safety of Workshop and Surroundings	1.1 Maintaining workshop safety 1.2 Handlling accidents and incidents 1.3 Handling fire accidents 1.4 Performing first aid 1.5 Maintaining environmental issues
2.0	Performing Preventive Maintenance of	2.1 Maintaining tools

Main competences		Specific competences
	Tools, Equipment, and Machines	2.2 Maintaining Equipment 2.3 Maintaining Workshop Machines
3.0	Performing Bench Work	3.1 Performing measuring 3.2 Performing mark off metal profile 3.3 Performing hand sawing 3.4 Performing power sawing 3.5 Performing Filing a metal 3.6 Performing Hand drilling 3.7 Performing Bench drilling 3.8 Performing Manual Thread Cutting
4.0	Performing Sheet Metal Work	4.1 Performing Hand Shearing 4.2 Performing Machine shearing 4.3 Performing chiseling 4.4 Performing Form Sheet metal 4.5 Performing Soft soldering 4.6 Performing Riveting 4.7 Performing Grinding
5.0	Performing shielded metal arc welding and arc cutting	5.1. Carrying out mild steel arc welding 5.2. Carrying out mild steel arc cutting
6.0	Performing gas welding and brazing on ferrous and non-ferrous metals	6.1. Carrying out sheet metal welding 6.2. Carrying out metal brazing and bronze welding 6.3. Carrying out metal cutting by gas flame.
7.0	Performing arc welding of alloy steels and ferrous metals.	7.1. Carrying out welding of alloy steels and ferrous metals 7.2. Carrying out welding of stainless and carbon steel by TIG welding 7.3. Carrying out welding of stainless and carbon steel pipes by MIG/MAG. 7.4. Filling worn-out metal surfaces. 7.5. Cutting steel plates using plasma-arc cutting. 7.6. Cutting steel plates using an electric arc cutting machine.
8.0	Performing Gas Welding on Ferrous and Non-Ferrous Metals	8.1 Carrying out welding of ferrous metals 8.2 Carrying Out Welding of Non-Ferrous Metals 8.3 Carrying out Oxy-Fuel Powder Cutting 8.4 Carry out Oxy-Fuel Gas Cutting
9.0	Performing Fabrication Works According to the Specification	9.1 Performing Sheet Metal Fabrication 9.2 Fabricating Structures of Steel Profiles 9.3 Fabricating Structures of Aluminum Profiles
10.0	Performing Site Installation Involving Welding	10.1 Carrying out Welding Works of Steel Structures
11.0	Performing Resistance Welding	11.1 Carrying out Resistance Welding on Sheet Metals
12.0	Performing arc welding on ferrous and non ferrous metals	12.1. Carry out arc welding on non-ferrous metals 12.2. Carrying out arc welding on high pressure vessels 12.3. Carrying out welding of steel structures 12.4. Carrying out laser-beam welding and cutting on metals
13.0	Performing advanced gas welding on ferrous and non-ferrous metals	13.1. Carrying out gas welding on ferrous and non-ferrous metals.
14.0	Performing advanced gas flame cutting on ferrous metals	14.1. Carrying out gas flame cutting on ferrous metals
15.0	Performing metal spraying on metal surfaces	15.1. Carry out metal spraying

Main competences		Specific competences
16.0	Performing advanced fabrication and pipe works	16.1. Carrying out metal plate works 16.2. Carrying out welding pipe works 16.3. Carrying out high density poly ethylene pipe welding (hdpe)
17.0	Performing welding testing and inspection of steel	17.1. Carrying out destructive testing 17.2. Carrying out non –destructive testing
18.0	Performing planning and managerial duties on preventive maintenance	18.1. Carrying out planning and report writing 18.2. Controlling and manage workshop tools and equipment 18.3. Controlling budget and production activities
19.0	Managing fabrication workshop activities	19.1. Designing workshop layout 19.2. Controlling tools and equipment movement 19.3. Estimating materials and labour cost 19.4 train subordinates 19.5. Maintaining records 19.6. Managing workshop business
20.0	Managing a safe work environment	20.1. Managing hazards 20.2. Carrying out risk assessment 20.3. Managing environmental issues

6.0. The Roles of Teachers, Students and Parents in Teaching and Learning

Good relationship between a teacher, student, parent, or guardian is fundamental to ensuring successful learning. This section outlines the roles of each participant in facilitating effective teaching and learning of Welding and Metal Fabrication.

7.0. The teacher

The teacher is expected to:

(a) Help the student to learn and develop the intended competences in Welding and Metal Fabrication

(b) Use teaching and learning approaches that will allow students with different needs and abilities to:

(i) Develops the competences needed in the 21st Century; and

(ii) Actively participate in the teaching and learning process.

(c) Use student centered instructional strategies that make the student a centre of learning which allow them to think, reflect and search for information from various sources;

(d) Create a friendly teaching and learning environment;

(e) Prepare and improvise teaching and learning resources;

(f) Conduct formative assessment regularly by using tools and methods which assess theory and practice;

(g) Treat all the students according to their learning needs and abilities;

(h) Protect the student from the risky environment while he or she is at school;

(i) Keep track of the student's daily progress;

(j) Identify individual student's needs and provide the proper intervention;

(k) Involve parents/guardians and the society at large in the student's learning process; and

(l) Integrate crosscutting issues and ICT in the teaching and learning process.

8.0. The student

The student is expected to:

(a) Develop the intended competences by participating actively in various learning activities inside and outside the classroom;

(b) Participate in the search for knowledge from various sources, including textbooks, reference books and other publications in online libraries.

9.0. The parent/guardian

The Parent/Guardian is expected to:

(a) Monitor the child's academic progress ;

(b) Where possible, provide a child with the needed academic support;

(c) Provide a child with a safe and friendly home environment which is conducive for learning;

(d) Keep track of a child's progress in behavior;

(e) Provide the child with any necessary materials required in the learning process; and

(f) Instill in a child a sense of commitment and positive value towards education and work.

10.0. Teaching and Learning Methods

The teaching and learning methods are instrumental in developing student's competences. This Syllabus suggests teaching and learning methods for each activity, which includes but not limited to demonstration, practical/hands-on activities, observations, role-play, simulation, group works, peer teaching/learning, discussions, presentations, field visits, research, and project works. However, a teacher is advised to plan and use other appropriate methods based on the environment or context. All the teaching and learning methods should be integrated with the everyday lives of students. The focus is expected to be on practical application and developing cognitive, affective, and psychomotor skills through learner-centred methods. Vocational teachers act as facilitators, incorporating both school base teaching and project work supervision.

11.0. Teaching and Learning Resources

The process of teaching and learning requires different resources. In that regard, both a teacher and students should work together to collect or improvise alternative resources available in the school and home environment when needed. Teachers and students are expected to constantly seek for information from various sources to effectively facilitate the teaching and learning process. The list of approved textbooks and reference books shall be provided by the TIE.

12.0. Assessment

Assessment is important in teaching and learning of Welding and Metal Fabrication. It is divided into formative and summative assessments. Formative assessment informs both the teacher and students on the progress of teaching and learning, and in making decisions on improving the teaching and learning process. Teachers are therefore, expected to apply a wide range of formative assessment methods which include but not limited to demonstrations, discussions, presentations, oral questions, experiments, observations, practical assignments and projects.

Summative assessment, on the other hand, will focus on determining student's achievement of learning. Teachers are expected to use a variety of summative assessments including Form Two National Assessment, terminal examination, annual examination, mock examination and project. The scores obtained from these assessments will be used as Continuous Assessment (CA). Therefore, the continuous assessments shall contribute 60% and the National Form IV Examination shall be 40% as indicated in Table 2.

Project work

Project work is a carefully planned and clearly defined task or problem that a student undertakes, either alone or in a group, to enhance and apply the skills and knowledge gained in the classroom, workshop, kitchen, or laboratory. It is based on the principles of "Learning by Doing" and "Learning by Living." In this context, the implementation of Project Work in secondary schools' vocational streams is essential. Projects in the vocational stream should be conducted in the core subject (occupation). To ensure its success, the supervision and assessment of student project work must be consistent with the established guidelines provided by National Examinations Council of Tanzania (NECTA).

Table 2: *Contribution of Continuous Assessment and National Examination in the Final Score*

Assessment Category	**Weight (%)**	**National Examination**
Form Two National Assessment (FTNA)	6.0	**40**
Form Three Terminal Examination	5.0	
Form Three Anual Examination	5.0	
Form Four Mock Examination	7.0	
Project	7.0	
Form Two Practical	10.0	
Form Three Practical	10.0	
Form Four Practical	10.0	
Total	**60**	

13.0. Number of Periods

The Welding and Metal Fabrication Syllabus for Ordinary Secondary Education

Vocational Stream Form I-IV provides time estimates for teaching and learning each specific competence. The estimates consider the complexity of the specific competences and the learning activities. Eight (08) periods of 40 minutes each have been allocated per week, whereby two (02) periods will be used for theory and 6 for practical sessions which may require double periods (e.g., 80). Double periods will allow sufficient time for hands-on activities.

14.0. Teaching and Learning Contents

The contents of the Syllabus are organised into a matrix with seven (07) columns which are main competences, specific competences, learning activities, suggested teaching and learning methods, assessment criteria which is dived into (process assessment, products/service assessment and underpinning knowledge), suggested teaching and learning resources and number of periods as presented in Table 3 to 6.

Form One

Table 3: *Detailed contents for Form One*

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per Unit
				Process Assessment	Services Assessment	Knowledge assessment		
1.0 Maintaining Safety of Workshop And Surroudning	1.1 Maintaining workshop safety	(a) Maintaining workshop safety rules	**Brainstorming**: Facilitate a session where the students brainstorm workshop safety rules and discuss their relevance to real-life scenarios **Group Discussion**: Encourage the students to share personal experiences and explore effective safety measures **Demonstration**: Show examples of improper and proper safety practices in the workshop **Hands-on Activity**: Guide the students in groups to inspect the workshop for hazards and identify relevant safety rules	The student should be able to: • Select relevant safety gears • Maintain workshop safety • Identify causes of health and safety hazards in a workshop and its surroundings • Interpret different safety signs in a workshop • Draw safety signs • Store tools, equipment and safety gear	Ensure the workshop surroundings are kept safe and organized following OSHA guidelines.	**Knowledge Evidence:** Detailed knowledge of: - Methods used: The Students should explain how to: - Maintain workshop safety - Clean workshop, tools, equipment, and machines safely **Principles:** The Students should explain principles of: - Workshop cleaning - Storing different types of tools and equipment used in the occupation **Theories:** The Students should explain: - Possible workshop accidents, their	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- • Tool kit • Spirit level • Multimeter • Safety boots • Gloves • Overalls • Cleaning materials • Hoe • Broom • Brush • Safety gears (PPE) • Dust covers • Dust mask • Dust bins • Personal hygiene kit	12

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per Unit
				Process Assessment	Services Assessment	Knowledge assessment		
			Case Study Analysis: Present examples of workshop accidents to discuss causes and preventive measures			causes, and prevention **Circumstantial Knowledge:** Detailed knowledge about: - OSHA rules and regulations - Safe working practices		
		(b) Maintaining personal safety	**Brainstorming**: Facilitate discussions to identify personal safety practices. **Demonstration**: Show proper use of personal protective equipment (PPE) such as helmets and goggles. **Role-Play**: Simulate scenarios involving improper personal safety practices and discuss consequences. **Practical Work**: Guide students in safe use of PPE and tools	The student should be able to: • Maintain a safe working environment • Maintain personal safety • Use safety gears • Take precautions against health and safety hazards	• Personal safety practices consistently maintained during activities.	**Knowledge Evidence:** Detailed knowledge of: - Safe working practices - Proper usage of personal protective equipment (PPE) - Principles of maintaining personal safety **Principles:** - Importance of personal safety in workshop settings - OSHA regulations regarding personal safety	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- • Safety boots • Over roll • Gloves • Dust mask • Safety helmets • Goggles • Ear plugs • Reflectors • Workshop safety posters. • Improper personal safety video scenarios flash/cd	
		(c) Maintaining personal hygiene	**Brainstorming**: Guide the students to brainstorm on	The student should be able to: • Clean tools,	Hygiene maintained as per safety and	**Knowledge Evidence:** Detailed	This element can be achieved at a work place or in a training institution.	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per Unit
				Process Assessment	Services Assessment	Knowledge assessment		
			the importance of personal hygiene and its role in maintaining health and safety in the workshop **Think-ink-pair-share**: Guide the students in think-ink-pair-share to identify personal hygiene practices, such as handwashing, cleaning PPE, and using protective clothing **Interactive simulation**: Guide the students through interactive simulations to explore hygiene-related scenarios, such as preventing contamination while handling hazardous materials or food **Class activities**: Guide the students through class activities to create and practice hygiene checklists,	equipment, and the workshop • Store tools and equipment properly • Dispose of waste following OHS guidelines • Maintain a clean and organized workspace	health standards	knowledge of: - Importance of personal hygiene in the workplace - The role of hygiene in preventing workplace hazards **Principles:** - Proper storage of tools and safety gear - Disposal of waste following OHS standards	The following tools, equipment and safety gears should be available:- - Personal hygiene kit - Cleaning materials (e.g., brooms, brushes, cleaning agents) - Dustbins - Waste disposal equipment. - Simulation game/video	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per Unit
				Process Assessment	Services Assessment	Knowledge assessment		
			including proper handwashing, PPE maintenance, and safe disposal of waste					
	1.2 Handling accidents and incidents	(a) Handling mechanical hazards	**Brainstorming**: Lead a session to define mechanical hazards and discuss their causes and effects **Role-Play**: Simulate mechanical hazard scenarios and guide the students in preventing **ICT Based Learning** By using a video clip let student explore how to handle mechanical hazards	The student must be able to: • Safely handle mechanical hazards using proper techniques • Perform first aid for mechanical hazard victims • Respond appropriately in simulated emergencies	Ability to use safety equipment and first aid procedures in mechanical accident situations	**Knowledge Evidence:** Detailed knowledge of: - Identifying mechanical hazards in the workshop - Safe practices for dealing with mechanical hazards - Basic first aid for mechanical injuries **Principles:** - Safe handling of mechanical equipment - Correct use of safety gear and equipment **Theories:** - Effects of mechanical accidents - Emergency life-saving techniques **Circumstantial Knowledge:**	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Tool kit - First aid kit - Safety boots - Gloves - Safety glasses - Overalls - Fire extinguisher - Workshop safety guidelines Computer Video Clip Internet	15

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per Unit
				Process Assessment	Services Assessment	Knowledge assessment		
						- Safe practices in handling mechanical tools and equipment		
		(b) Handling physical hazards	**Brainstorming**: Discuss various physical hazards and their potential consequences **Demonstration**: Show safe practices to prevent falls, or other physical injuries **Practical Activity**: Guide the students in identifying common physical hazards in the workshop	The student must be able to: • Safely manage physical hazards, including falls and impacts • Perform emergency responses to physical injuries	Demonstrate knowledge of physical hazards and safety gear use	**Knowledge Evidence:** Detailed knowledge of: - Types of physical hazards in a workshop (e.g., falls, impacts) - Correct emergency response for physical injuries **Principles:** - Importance of using personal protective equipment (PPE) - First aid techniques for physical injuries **Theories:** - Effects of physical injuries - Prevention and treatment of falls and impacts - Emergency life-saving procedures **Circumstantial Knowledge:**	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Rubber gloves - Safety boots - First aid kit - Helmet - Ear plugs - Safety glasses - Workshop safety rules.	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per Unit
				Process Assessment	Services Assessment	Knowledge assessment		
						- Safe practices for preventing physical accidents - Proper handling of workshop tools to avoid physical injuries		
		(c) Handling chemical hazards	**Brainstorming**: Discuss types of hazardous chemicals commonly found in workshops - **Demonstration**: Show safe chemical handling practices and use of safety equipment like gloves and goggles. - **Practical Work**: Guide the students in practising safe disposal of chemicals and cleaning spills - **Scenario-Based Learning**: Simulate chemical spill incidents and guide the students in responding appropriately	The student must be able to: • Safely handle hazardous chemicals and prevent accidents • Administer first aid for chemical burns or poisoning • Properly use safety equipment, including chemical suits and gloves	Chemical hazards properly handled with correct use of protective equipment	**Knowledge Evidence:** Detailed knowledge of: - Types of chemicals and their hazards in the workshop - Correct use of safety equipment when handling chemicals - First aid for chemical injuries **Principles:** - Safe handling of chemicals in the workshop - Emergency response to chemical accidents **Theories:** - Effects of chemical exposure and burns - First aid treatment for	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Safety boots - Rubber gloves - First aid kit - Chemical spill kits - Chemical suits - Goggles - Fire extinguisher. - Chemical handling mannual	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per Unit
				Process Assessment	Services Assessment	Knowledge assessment		
						chemical injuries - Usage of color codes and safety signs in chemical handling **Circumstantial Knowledge:** - Safe disposal methods for hazardous chemicals - Risk assessment for chemical handling		
		(d) Handling electrical hazards	**Brainstorming**: Lead discussions on common electrical hazards and their prevention - **Demonstration**: Show proper handling of electrical equipment and emergency response for shocks - **Activity**: Guide the students to inspect tools and equipment for potential electrical hazards - **Role-Play**:	The student must be able to: • Safely handle electrical hazards and accidents • Perform emergency procedures for electrical shocks, including artificial respiration • Use electrical safety equipment properly	Correct emergency response to electrical accidents demonstrated	**Knowledge Evidence:** Detailed knowledge of: - Types of electrical hazards in the workshop - Safe procedures for dealing with electrical equipment **Principles:** - Proper use of electrical safety gear - Electrical accident prevention techniques - Treatment for	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Electrical tools - Safety gloves - Safety boots - First aid kit - Fire extinguisher - PPE (e.g., rubber gloves, insulated mats) - Service manuals for electrical equipment	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per Unit
				Process Assessment	Services Assessment	Knowledge assessment		
			Simulate electrical accidents and practice emergency procedures such as artificial respiration			electrical shock **Theories:** - Effects of electrical shock - How to prevent electrical accidents - Treatment for electrical shock **Circumstantial Knowledge:** - Safe practices for working with electrical equipment - Emergency procedures for electrical injuries		

		(e) Handling accidents and incidents	**Practical Work:** Guide the Students to practice accident management from start to finish, including emergency procedures and reporting **Activity:** Encourage the Students to perform the role of the first responder in a simulated emergency	The student must be able to: • Manage accidents and incidents from start to finish, including emergency procedures and reporting • Act as the first responder in simulated emergencies	Accident reports filled out correctly; procedures followed as per safety guidelines	**Knowledge Evidence:** Detailed knowledge of: - General accident prevention techniques - Procedures for reporting and recording accidents - Emergency life-saving techniques **Principles:** - Accident prevention practices - Correct use of safety equipment in emergencies **Theories:** - Emergency procedures for various accidents (chemical, mechanical, electrical, physical) - CPR and basic life support techniques - Workplace accident reporting methods **Circumstantial Knowledge:** - Procedures for storing and handling emergency equipment - Safe handling and storage of hazardous materials	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - First aid kit - Safety boots - Helmets - Gloves - Fire extinguisher - CPR mask - Emergency response manuals - Safety posters and guidelines	

	1.3 Handling fire accidents	(a) Performing fire classification	**Demonstration**: Show how to classify different types of fires **Activity**: Guide the students to identify various fire types in the workshop and classify them **Discussion**: Guide students in small groups to different fire types and corresponding firefighting methods	The student must be able to: • Identify and classify different types of fires • Demonstrate knowledge of appropriate firefighting methods for each fire type	Different types of fire classified as per OSHA	**Knowledge Evidence:** Detailed knowledge of: - Types of fire and their classifications - Common classes of fire **Principles:** - The use of fire extinguishers for various fire types **Theories:** - Classification of fire types and fire extinguishers - Methods to prevent fire hazards in the workshop **Circumstantial Knowledge:** - OSHA rules	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Fire extinguishers - Fire classification guide - Safety boots - Gloves - Firefighting materials - First aid kit	12

		(b) Performing firefighting	**Demonstration**: Show the correct use of fire extinguishers and firefighting materials **Practical Work**: Have the students practice using fire extinguishers on simulated fires **Role-play**: Simulate fire scenarios and guide students through firefighting techniques	The student must be able to: • Correctly use fire extinguishers and firefighting materials for different fire types • Perform firefighting techniques on simulated fires • React appropriately during simulated fire scenarios	Firefighting equipment and materials used as per instructions	**Knowledge Evidence:** Detailed knowledge of: - Firefighting techniques and materials - How to handle different fire types - Proper use of fire extinguishers **Principles:** - Safe and correct use of fire extinguishing agents - Types of fire extinguishing equipment **Theories:** - Effects of different fire types on materials and equipment - Treatment of burn injuries - Safety protocols during firefighting **Circumstantial Knowledge:** - Firefighting rules and regulations - Importance of using appropriate materials for firefighting	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Fire extinguishers - Firefighting suits - First aid kit - Fire alarms - Safety boots - Fire safety equipment - Simulation game /video about fire fighting

		(c) Maintaining fire alarms and detectors	**Demonstration**: Show how to maintain and test fire alarms and detectors **Activity**: Guide the students in checking and testing fire alarms **Discussion**: Discuss the importance of regular maintenance of fire safety equipment **Scenario-based Learning**: Present a faulty fire alarm scenario and have the students diagnose and fix it	The student must be able to: • Identify tools for checking fire alarms and detectors • Maintain and test fire alarms and detectors for proper functionality • Perform test checks on fire alarms and detectors	Fire alarms and Detectors maintained as per specified standards	**Knowledge Evidence:** **Methods** Detailed knowledge of: - How to maintain fire alarms and detectors - Troubleshooting fire alarms and detectors **Principles:** - Correct maintenance procedures for fire detection systems **Theories:** - How fire alarms work - Importance of fire detection systems in the workshop - Procedures for handling and maintaining safety alarms **Circumstantial Knowledge:** - Safe handling and maintenance of fire detection equipment - Regular testing of fire alarms	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Fire alarms - Fire detector testing tools - Fire extinguishers - Maintenance logs - Safety boots - Gloves - Fire safety manuals	

	1.4 Performing first aid	(a) Maintaining first aid	**Demonstration**: Show how to properly manage a first aid kit and ensure it is well stocked **Activity**: Guide the students in checking and restocking first aid kits **Discussion**: Discuss different types of injuries and the importance of having a well-prepared kit **Problem Solving**: Simulate an emergency scenario where the first aid kit needs to be used	The student must be able to: • Maintain a first aid kit by checking and restocking necessary items • Understand the types of injuries and ensure the kit is well prepared for emergencies • Demonstrate proper management of first aid resources	First aid equipment and supplies maintained as required	**Knowledge Evidence:** Detailed knowledge of: **Methods:** Procedures for maintaining first aid kit contents - Safety precautions when maintaining first aid equipment **Principles:** - Correct storage and maintenance of first aid kits **Theories:** - The need for proper first aid preparedness **Circumstantial Knowledge:** - Safe handling of first aid tools	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - First aid kit - Medical gloves - Sterilizer - Towel - Stretcher - Safety boots - Medical tools	14

		(b) Performing artificial respiration	**Demonstration**: Show the steps to perform artificial respiration **Practical Work**: Have the students practice artificial respiration on a manikin **Discussion**: Discuss signs of respiratory failure and the importance of artificial respiration in emergencies **Role-Play**: Simulate emergency scenarios requiring artificial respiration and guide the students through the process	The student must be able to: • Perform artificial respiration effectively on a manikin • Recognize signs when artificial respiration is necessary • Understand the importance of artificial respiration in emergencies	Artificial respiration performed as requires	**Knowledge Evidence:** Detailed knowledge of: - Types of artificial respiration - Importance of artificial respiration in saving lives - Signs of respiratory failure **Principles:** - Performing artificial respiration correctly - Signs indicating when artificial respiration is necessary **Theories:** - Effects of oxygen deprivation - Steps in performing artificial respiration - Techniques for delivering life-saving breaths **Circumstantial Knowledge:** - Basic life-saving techniques - Emergency procedures for respiratory failure	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Manikin for practice - First aid kit - Medical gloves - Emergency response plan - Safety boots - Medical tools

		(c) Performing first aid to minor injuries	**Demonstration**: Show how to attend to cuts, bruises, and burns **Practical Work**: Have the students practice cleaning and dressing wounds on manikin **Role-play**: Simulate common workshop injuries and guide the students in providing first aid **Discussion**: Discuss methods to prevent infection in minor injuries and the importance of timely first aid	The student must be able to: • Attend to minor injuries like cuts, bruises, and burns • Clean and dress wounds appropriately • Apply first aid procedures for common workshop injuries	Ability to treat and prevent infection in minor injuries	**Knowledge Evidence:** Detailed knowledge of: **Methods:** - First aid treatment for minor injuries - Sterilization and infection prevention **Principles:** - Proper sterilization and cleaning of injuries - Correct method for treating minor wounds and burns **Theories:** - Risks associated with improper wound care - Signs of infection and how to treat wounds - First aid for minor injuries and their treatment **Circumstantial Knowledge:** Safety Precautions	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - First aid kit - Medical gloves - Sterilizer - Gauze - Bandages - Antiseptic - Safety boots	

	1.5 Maintaining environmental issues	(a) Maintaining environmental pollution	**Discussion**: Discuss various types of environmental pollution and their impact on the workshop **Activity**: Guide the students in identifying and addressing pollution issues in the workshop **Practical Work**: Demonstrate how to keep a clean and sustainable work environment **Case Study**: Present environmental issues in workshops and have students propose solutions	The student must be able to: • Identify and address environmental pollution issues in the workshop • Maintain a clean and sustainable working environment • Understand the impact of pollution on the workshop and surrounding areas	Ability to maintain a clean and safe working environment according to environmental standards	**Knowledge Evidence:** Detailed knowledge of: **Methods:** - Methods for mitigating pollution **Principles:** - Sustainable construction practices - Maintaining a safe working environment **Theories:** - Environmental standards and regulations - Importance of preventing pollution **Circumstantial Knowledge:** - Safety Rule	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Dust bin - Rack - Chalkboard - Whiteboard - Pictures/charts - Cleaning materials - Slasher - Bush knife	11

		(b) Maintaining safe waste disposal	**Demonstration**: Show how to dispose of various types of waste correctly **Activity**: Have the students practise separating waste into recyclable and non-recyclable categories **Discussion**: Discuss the importance of proper waste disposal in maintaining a safe and clean workshop **Simulation**: Create scenarios where students must manage waste disposal in a safe and environmentally friendly manner	The student must be able to: • Correctly dispose of various types of waste in the workshop • Practice safe waste disposal methods, including the separation of recyclable and non-recyclable waste • Understand the importance of waste disposal in maintaining a safe and clean workshop environment	Safe waste disposal maintained as per safety rules and regulations	**Knowledge Evidence:** Detailed knowledge of: - Methods for disposing of different types of waste - Safe handling of tools and materials used in waste disposal **Principles:** - Waste classification - Waste disposal techniques **Theories:** - The hazards associated with improper waste disposal - Environmental regulations on waste disposal **Circumstantial Knowledge:** - Waste management practices	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Dust covers - Dust masks - Broom - Hoe - Brush - Safety boots - Shovel	

2.0 Performing Preventive Maintenance of Tools, Equipment, and Machines	2.1 Maintaining tools	(a) Maintaining measuring tools	**Demonstration:** Show how to properly maintain measuring tools **Activity:** Guide the Students in re-sharpening and oiling measuring tools **Discussion:** Explain the importance of tool maintenance in the workshop	The student must be able to: • Identify measuring tools and materials to be used • Properly maintain and re-sharpen measuring tools • Oil and clean measuring tools as needed	Tools maintained as per manufacturer's specifications	**Knowledge Evidence:** Detailed knowledge of: - Methods for maintaining measuring tools **Principles:** - Principles of tool maintenance **Theories:** - Types of maintenance - Oiling and greasing techniques - Importance of maintaining tools **Circumstantial Knowledge:** - Safety precautions in tool maintenance	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Cutting tools - Measuring tools - Oilcan, grease gun - Brushes 1"-4" - Safety boots - Gloves - Helmet	33
		(b) Maintaining marking out tools	**Brainstorming**: Guide the students to brainstorm the proper maintenance techniques for marking tools, considering aspects such as re-sharpening and using the correct oils and greases **Think-Ink-Pair-Share**: Guide the students through think-ink-pair-share to explain the importance of	The student must be able to: • Identify tools and materials • Properly maintain marking out tools by applying correct techniques • Re-sharpen tools as needed and use appropriate oil and grease	Marking tools properly maintained according to specification	**Knowledge Evidence:** Detailed knowledge of: **Methods:** Sharpening and oiling techniques **Principles:** - Principles for maintaining marking out tools **Theories:** - Common faults in marking tools and their prevention - Types of	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Marking tools - Oilcan, grease gun - Safety boots - Helmet - Gloves - Maintenance simulation video game	

			marking tools in precision work and share their thoughts on the maintenance techniques they think are most effective **Interactive Simulation**: Guide the students through an interactive simulation to explore the impact of properly maintained marking tools on the accuracy and efficiency of precision tasks **Class Activities**: Guide the students through class activities to practice marking techniques, re-sharpening, and using the right oils and greases for effective tool maintenance			markings required in metal fabrication **Circumstantial Knowledge:** - Safety Precautions	

		(c) Maintaining cutting tools	**Brainstorming**: Guide the students to think about how to sharpen and maintain cutting tools, and the best ways to do it for different tools **Think-Ink-Pair-Share**: Guide the students through Think-Ink-Pair-Share to explain why keeping cutting edges sharp and clean is important, and to share their ideas on how to maintain tools **Interactive Simulation**: Guide the students through an interactive simulation to show how to sharpen and maintain cutting tools and see the difference between sharp and dull edges	The student must be able to: • Identify tools and materials to be used • Properly sharpen and maintain cutting tools • Maintain cutting edges clean and sharp	Cutting tools maintained according to manufacturer's specifications	**Knowledge Evidence:** Detailed knowledge of: - Cutting tools maintenance techniques **Principles:** - Principles for maintaining cutting tools for performance **Theories:** - The impact of worn cutting tools - The role of cutting tool maintenance in machine longevity **Circumstantial Knowledge:** - Safe handling and operation of cutting tools	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Cutting tools - Oilcan, grease gun - Safety boots - Gloves - Tools grinding machine - Sharpener stone	

	2.2 Maintaining Equipment	(a) Maintaining trolleys, workbench	**Brainstorming**: Guide the students to think about cleaning, lubricating, and maintaining trolleys and workbenches **Think-Ink-Pair-Share**: Guide students to explain the importance of maintenance and share safe practices **Interactive Simulation**: Guide the students through simulating the maintenance process for trolleys and workbenches **Class Activities**: Guide the students to practice maintenance, ensuring safety standards are followed	The student must be able to: • Clean, lubricate, and maintain trolleys and workbenches according to safety standards • Perform maintenance tasks to ensure the proper functioning of trolleys and workbenches	Equipment maintained according to manufacturer's specifications	**Knowledge Evidence:** Detailed knowledge of: - Procedures for maintaining trolleys and workbenches **Principles:** - Principles for maintaining workshop equipment **Theories:** - Importance of lubrication and maintenance for equipment longevity - The role of preventive maintenance in safety **Circumstantial Knowledge:** - Safety precautions when handling and maintaining equipment	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Compressors - Workbenches - Oilcan, grease gun - Safety boots - Gloves - Service tools box spanner	47

		(b) Maintaining compressors, heat treatment furnaces	**Practical Demonstration:** Show how to lubricate and maintain compressors and heat treatment furnaces **Discussion:** Discuss safety measures when working with compressors and furnaces, especially regarding heat and pressure risks **Activity:** Guide the Students in the safe operation and maintenance of these equipment items	The student must be able to: • Safely lubricate and maintain compressors and heat treatment furnaces • Operate compressors and furnaces in a safe manner • Identify and mitigate heat and pressure risks during operation and maintenance	Equipment maintained and operational according to specifications	**Knowledge Evidence:** Detailed knowledge of: - Maintenance procedures for compressors and furnaces **Principles:** - Principles of machinery lubrication **Theories:** - Preventive maintenance techniques for compressors - Safe operation of heat treatment furnaces **Circumstantial Knowledge:** - How environmental factors affect equipment maintenance	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Compressors - Heat treatment furnaces - Oilcan, grease gun - Safety boots - Gloves - Service tools box spanner	

	2.3 Maintaining Workshop Machines	(a) Maintaining power machines	**Demonstration:** Show how to maintain power machines, including oiling, greasing, and performing basic maintenance **Guided Practice:** Guide the students in identifying and fixing issues with power machines **Discussion:** Discuss the importance of power machine maintenance for effective operation	The student must be able to: • Identify tools and materials to be used • Maintain power machines, including oiling, greasing, and basic maintenance • Identify and resolve issues with power machines	Machines properly maintained and ready for use	**Knowledge Evidence:** Detailed knowledge of: **Methods**: - Machine maintenance procedures **Principles:** - Machine maintenance principles **Theories:** - Preventive maintenance techniques for power machines - Importance of machine parts care **Circumstantial Knowledge:** Safety rules and regulations	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Power machines - Oilcan, grease gun - Safety boots - Gloves - Helmet - Service tools box spanner	47

		(b) Maintaining manual machines	**Brainstorming**: Guide the students to think about how to maintain manual machines, including lubrication and sharpening **Think-Ink-Pair-Share**: Guide students to discuss common faults in manual machines and ways to prevent them **Interactive Simulation**: Guide the students through simulating the process of cleaning, greasing, and storing manual machines **Class Activities**: Guide the students to practice maintaining manual machines, focusing on lubrication, sharpening, and proper storage	The student must be able to: • Identify tools and materials to be used • Maintain manual machines by performing tasks like lubrication, cleaning, and sharpening • Identify and prevent common faults in manual machines • Safely store manual machines after maintenance	Machines properly maintained as per the manufacturer's specifications	**Knowledge Evidence:** Detailed knowledge of: - Procedures for maintaining manual machines **Principles:** - Principles of lubrication and cleaning for manual machines **Theories:** - The role of lubricants in manual machine longevity - Maintenance schedules for manual machines **Circumstantial Knowledge:** - Safety procedures for manual machines - Environmental effects on manual machine maintenance	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Manual machines - Safety boots - Gloves - Oilcan, grease gun - Maintenance tool kit	

3.0 Performing Bench Work	3.1 Performing measuring	(a) Using linear measuring tools	**Brainstorming**: Guide the students to think about using measuring tools like tape measures and steel rules **Think-Ink-Pair-Share**: Guide students to discuss proper measurement techniques **Interactive Simulation**: Guide the students through using measuring tools for accuracy **Class Activities**: Guide the students to practice measuring length, width, and height	The student must be able to: • Identify tools and materials to be used • Use linear measuring tools (eg, tape measures, steel rules) accurately • Measure length, width, and height as per task requirements	Accurate measurements documented according to work specifications	**Knowledge Evidence:** Detailed knowledge of: - Methods for using linear measuring tools **Principles:** - Principles of measurement and positioning the work piece correctly **Theories:** - Types of linear measuring tools - Material properties of measuring tools - Units of measurement and their conversion **Circumstantial Knowledge:** - Safety rules and regulations - Measuring environmental requirements	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Tape measure - Steel rule - Vernier caliper - Scriber - Centre punch - Divider - Trammel - Ball pein hammer - Overalls - Safety boots	33

		(b) Using angular measuring tools	**Demonstration:** Show students how to use angular measuring tools such as protractors and bevels **Activity:** Have the students practice measuring angles and marking them accurately **Discussion:** Explain the importance of accuracy in angular measurement	The student must be able to: • Identify tools and materials • Use angular measuring tools (eg. protractors, bevels) accurately • Measure and mark angles with precision • Understand the importance of accuracy in angular measurement	Angular measurements conforming to work piece specifications	**Knowledge Evidence:** Detailed knowledge of: - Methods for measuring angles **Principles:** - Proper usage of angular tools **Theories:** - Types of angular measuring tools - How to read and apply angular measurements **Circumstantial Knowledge:** - Safety rules and regulations - Environmental factors affecting angular measurements	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Protractor - Bevels - Overalls - Safety boots	27

		(c) Using non-linear/non-angular measuring tools	**Demonstration:** Show how to use tools such as calipers and dividers for non-linear measurements **Activity:** Guide the students in using these tools for specific tasks **Classroom Exercise:** Discuss common faults in non-linear measurements and how to avoid them	The student must be able to: • Identify tools and Materials • Use non-linear measuring tools, such as calipers and dividers, for accurate measurements • Apply non-linear measurement techniques in specific tasks • Identify and avoid common faults in non-linear measurements	Non-linear measurements conforming to given specifications	**Knowledge Evidence:** Detailed knowledge of: - Methods for using non-linear/non-angular tools **Principles:** - Understanding how to apply these tools correctly **Theories:** - Parts and structure of non-linear tools - Accuracy required for non-linear measurements **Circumstantial Knowledge:** - Safety rules and regulations dividers - Environmental factors that affect non-linear measurements	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Vernier caliper - Divider - Try square - Overalls - Safety boots	27

	3.2 Performing mark off metal profile	(a) Marking off liner plate	**Brainstorming**: Guide the students to think about marking off a linear plate accurately. **Think-Ink-Pair-Share**: Guide students to discuss challenges and solutions when marking metal profiles. **Interactive Simulation**: Guide the students through marking a metal profile based on specifications. **Class Activities**: Guide the students to practice marking metal profiles accurately.	The student must be able to: • Identify tools and materials to be used • Accurately mark off a linear plate according to specifications • Identify and resolve common issues encountered during the marking process	Metal profile Marked off according to specifications	**Knowledge Evidence:** Detailed knowledge of: - Methods of marking off metal profiles **Principles:** - Correct technique for marking off metal profiles **Theories:** - Common methods of metal profile marking - Types of metal profiles and their uses **Circumstantial Knowledge:** - Safe handling of tools when marking off	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Tape measure - Steel rule - Scriber - Ball pain hammer - Overalls - Safety boots	41

		(b) Marking off an I-beam	**Demonstration:** Show how to mark off an I-beam **Practical Exercise:** Guide the students in performing the marking-off process for an I-beam **Activity:** Discuss the importance of I-beam profiles in construction and their marking methods	The student must be able to: • Identify tools and materials to be used • Mark off an I-beam accurately • Perform the marking-off process for I-beams • Understand the significance of I-beam profiles in construction and marking methods	I-beam profile accurately marked off	**Knowledge Evidence:** Detailed knowledge of: - Methods of marking I-beams **Principles:** - Correct technique for marking off I-beams **Theories:** - Materials used for I-beams - Common mistakes when marking off I-beams **Circumstantial Knowledge:** - Safety rules and regulations	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Tape measure - Steel rule - Scriber - Centre punch - Overalls - Safety boots	21

		(c) Marking off and fabricate an angle iron bracket	**Brainstorming**: Guide the students to think about marking and fabricating an angle iron bracket **Think-Ink-Pair-Share**: Guide students to discuss the application and importance of angle iron brackets **Interactive Simulation**: Guide the students through marking and fabricating an angle iron bracket as per specifications **Class Activities**: Guide the students to practice marking off and fabricating angle iron brackets	The student must be able to: • Identify tools and materials to be used • Mark off and fabricate an angle iron bracket according to specifications • Demonstrate proper fabrication techniques for angle iron brackets • Discuss the application and importance of angle iron brackets in construction and fabrication	Fabricated bracket matches design and specifications	**Knowledge Evidence:** Detailed knowledge of: **Methods**: - Angle iron bracket fabrication methods **Principles:** - Marking off and fabricating angle iron brackets correctly **Theories:** - Common challenges in fabricating angle iron brackets **Circumstantial Knowledge:** - Safety rules and regulations	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Angle iron - Steel ruler - Vernier caliper - Try square - Overalls - Safety boots	21

		(d) Marking off and fabricate a pipe reducer	**Demonstration:** Show how to mark off and fabricate a pipe reducer. **Practical Exercise:** Allow the students to perform the task of marking off and fabricating a pipe reducer. **Discussion:** Explain the importance of precision in fabricating pipe reducers for plumbing and construction.	The student must be able to: • Identify tools and materials to be used • Mark off and fabricate a pipe reducer according to specifications. • Demonstrate precision in the fabrication process. • Understand the importance of accurate pipe reducer fabrication for plumbing and construction.	Pipe reducer fabricated as per given design specifications.	**Knowledge Evidence:** Detailed knowledge of: - Fabricating pipe reducers **Principles:** - Correct methods for marking and fabricating reducers **Theories:** - Types of pipe reducers and their uses - Material properties affecting pipe reducer fabrication **Circumstantial Knowledge:** - Safety considerations in pipe reducer fabrication	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Pipe reducer materials - Tape measure - Scriber - Try square - Overalls - Safety boots	21

	3.3 Performing hand sawing	(a) Performing straight sawing	**Brainstorming**: Guide the students to define and explain first straight sawing **Think-Ink-Pair-Share**: Guide the students to discuss how to perform straight sawing **Interactive Simulation**: Guide the students through performing straight sawing **Class Activities**: Organize students into groups to practice straight sawing	The student must be able to: • Perform straight sawing on metal according to technical specifications • Achieve accurate straight cuts • Understand the importance of precision in straight sawing	Straight sawing conforms to technical specifications	**Knowledge Evidence:** Detailed knowledge of: - Techniques for straight sawing **Principles:** - Proper techniques for straight cuts **Theories:** - Understanding metal types and properties - Types of hacksaw blades and their use in straight sawing - Understanding the concept of Teeth per Inch (TPI) **Circumstantial Knowledge:** - Safety precautions in hand sawing - Procedures for rectifying crooked cuts	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Working drawing - Scriber - Bench bush - Hacksaw blade - Measuring tape - Bench vice - Try square - Centre punch - Work bench - Ball pein hammer - Overalls - Industrial boots	35

		(b) Performing angular sawing	**Demonstration:** Show how to perform angular sawing on metal **Practical Exercise:** Let the students practice cutting at different angles according to given specifications **Group Work:** Discuss the importance of setting the correct angle before cutting	The student must be able to: • Perform angular sawing on metal according to given specifications • Cut at various angles accurately • Set the correct angle before cutting to ensure precision	Angular cuts conform to technical specifications	**Knowledge Evidence:** Detailed knowledge of: - Methods for angular sawing **Principles:** - Importance of setting angles correctly **Theories:** - Understanding angular sawing - Methods for setting saw blades for angled cuts - Different TPI types and their applications for angular cuts **Circumstantial Knowledge:** - Safety precautions in angular sawing - How to fix errors when sawing angularly	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Hacksaw - Scriber - Try square - Ball pain hammer - Work bench - Overalls - Industrial boots	
	3.4 Performing power sawing	(a) Sawing a round bar	**Demonstration:** Show how to use a power saw to cut a round bar **Practical Exercise:** Have the students cut round bars using the power saw **Group Work:** Discuss safety procedures and	The student must be able to: • Use a power saw to accurately cut a round bar • Demonstrate safety procedures and proper techniques during the	Round bar cut matches technical requirements	**Knowledge Evidence:** Detailed knowledge of: - Power saw operation for round bars **Principles:** - Setting power saw for round bars - Selection of the right blade for	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Power saw machine - Power saw blades - Vernier caliper	45

		proper techniques when cutting round bars	cutting process • Work effectively in a group, discussing and applying safe practices when sawing round bars		round bar cutting **Theories:** - Types of round bars and their metal properties - Different types of blades and their TPI for round bar cutting **Circumstantial Knowledge:** - Safety precautions when working with power saws - Environmental factors when using power saw	- Centre punch - Workbench - Overalls - Safety boots	
	(b) Sawing a flat bar	**Brainstorming**: Guide the students to think about using a power saw to cut a flat bar **Think-Ink-Pair-Share**: Guide the students to discuss how to select the right blade and set the correct speed for cutting flat bars **Interactive Simulation**: Guide students in using a power saw to cut flat bars **Class Activities**: Have students practise cutting flat bars with a power saw	The student must be able to: • Safely operate a power saw to cut flat bars • Select the correct blade for cutting flat bars • Set the appropriate speed for the saw • Ensure accurate cuts as per specifications	Flat bar cut conforms to given specifications	**Knowledge Evidence:** Detailed knowledge of: - Power saw operation for flat bars **Principles:** - Setting the correct speed for cutting flat bars - Importance of selecting the appropriate blade **Theories:** - Material properties of flat bars - TPI selection for flat bar cutting - Cooling media for cutting flat bars	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Power saw machine - Power saw blades - Vernier caliper - Centre punch - Workbench - Overalls - Safety boots	

						Circumstantial Knowledge: - Safety protocols during power sawing - Power saw machine operational procedures		
	3.5 Filing a metal	(a) Performing cross filling	**Demonstration:** Show how to perform cross-filing on metal **Practical Exercise:** Guide the students through filing a metalwork piece using the cross-filing technique **Group Discussion:** Explain the advantages and applications of cross filing in various tasks	The student must be able to: • Perform cross-filing on metal using the appropriate technique • File a metalwork piece accurately with cross-filing • Explain the advantages and applications of cross-filing in different tasks	File work piece conforms to technical specifications	**Knowledge Evidence:** Detailed knowledge of: - Cross-filing technique **Principles:** - Importance of correct filing technique **Theories:** - Filing process and the role of cross filing - Types of files used for cross filing - Materials that can be filed **Circumstantial Knowledge:** - Filing errors and how to prevent them	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Files - Centre punch - Workbench - Bench vice - Ball pein hammer - Soft brush - Scriber - Measuring tape - Divider - Overalls - Leather gloves - Safety goggles	140

		(b) Performing draw filling	**Brainstorming**: Guide the students to think about the draw filling technique for metal **Think-Ink-Pair-Share**: Guide the students to discuss the advantages and uses of draw filling in metalwork **Interactive Simulation**: Guide the students through filing a metal piece using the draw filling technique **Class Activities**: Have students practise draw filling on metal	The student must be able to: • Perform draw filling on metal using the appropriate technique • File a metalwork piece accurately with draw filling • Explain the advantages and applications of draw filling in different tasks	File work piece conforms to technical specifications	**Knowledge Evidence:** Detailed knowledge of: - Draw filling technique **Principles:** - Importance of correct filing technique **Theories:** - Filing process and the role of draw filling. - Types of files used for draw filling. - Materials that can be filed **Circumstantial Knowledge:** - Filing errors and how to prevent them	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Files - Centre punch - Workbench - Bench vice - Ball pein hammer - Soft brush - Scriber - Measuring tape - Divider - Overalls - Leather gloves - Safety goggles

		(c) Performing longitudinal filling.	**Demonstration:** Show how to perform longitudinal filling on metal **Practical Exercise:** Guide the students through filing a metalwork piece using the longitudinal filling technique **Group Discussion:** Explain the advantages and applications of longitudinal filling in various tasks	The student must be able to: • Perform longitudinal filling on metal using the appropriate technique • File a metalwork piece accurately with longitudinal filling • Explain the advantages and applications of longitudinal filling in different tasks	File work piece conforms to technical specifications	**Knowledge Evidence:** Detailed knowledge of: - Longitudinal filling technique **Principles:** - Importance of correct filing technique **Theories:** - Filing process and the role of longitudinal filling. - Types of files used for draw filling. - Materials that can be filed **Circumstantial Knowledge:** - Filing errors and how to prevent them	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Files - Centre punch - Workbench - Bench vice - Ball pein hammer - Soft brush - Scriber - Measuring tape - Divider - Overalls - Leather gloves - Safety goggles	

	3.6 Hand drilling	(a) Drilling a hole on a plate	**Demonstration:** Show the correct procedures for drilling a hole on a plate **Practical Exercise:** Guide the students through the process of selecting appropriate drill bits, clamping, and drilling a hole on metal **Group Activity:** Discuss the importance of selecting the right drill bit and speed	The student must be able to: • Select appropriate drill bits for the job • Properly clamp the plate for drilling • Drill a hole on a metal plate using correct procedures • Understand the importance of selecting the correct drill bit and speed	Hole drilled is accurate, clean, and conforms to given technical specifications	**Knowledge Evidence:** Detailed knowledge of: - Drilling procedures - Measurement techniques **Principles:** - Hand drilling machine operation - Speed and bit selection - Correct techniques for metal drilling **Theories:** - Properties of different metals - Understanding of drawings - Types of drills and their applications **Circumstantial Knowledge:** - Safety protocols while using hand-drilling machines - Operational procedures	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Working drawing - Centre punch - Scriber - Measuring tape - Divider - Protractor - Ball pein hammer - Bench vice - Hand drilling machine - Chuck key - Try square - Overalls - Safety boots - Safety goggles	44

	3.7 Bench drilling	(a) Drilling a hole on a plate	**Demonstration:** Show how to drill a hole using the bench-drilling machine **Practical Exercise:** Guide the students in positioning the work piece, selecting the correct speed, and drilling accurately **Group Discussion:** Discuss the factors that affect drilling speed, such as material and hole size	The student must be able to: • Position the work piece and select the correct speed for drilling • Drill accurately using the bench-drilling machine • Understand factors affecting drilling speed, such as material type and hole size	Drilled hole conforms to technical specifications in terms of diameter, depth, and alignment	**Knowledge Evidence:** Detailed knowledge of: - Bench drilling procedures - Measuring techniques **Principles:** - Bench drilling machine operation - Speed and feed adjustments for different materials - Correct use of drill bits **Theories:** - Types of materials and their compatibility with specific drilling techniques - Basic calculations for feed and speed **Circumstantial Knowledge:** - Work area setup for safe bench drilling operation.	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Working drawing - Centre punch - Measuring tape - Drill bits - Bench drilling machine - Chuck key - Machine vice - Safety boots - Overalls - Goggles	44
		(b) Counter-sinking a drilled hole	**Brainstorming**: Guide the students to think about using counter-sink bits to widen drilled holes **Think-Ink-Pair-Share**: Guide the students to discuss the correct drill bits and machine	The student must be able to: • Use counter-sink bits to widen the opening of drilled holes • Select and apply correct drill bits and	Counter-sunk holes meet technical requirements (size and angle)	**Knowledge Evidence:** Detailed knowledge of: - Counter-sinking techniques - Types of counter-sink bits **Principles:** - Proper usage of	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Counter-sink bits	

				settings for counter-sinking **Interactive Simulation**: Guide the students through counter-sinking drilled holes with the correct tools **Class Activities**: Have the students practise counter-sinking holes using the proper drill bits and settings	machine settings for counter-sinking • Perform counter-sinking accurately on drilled holes		counter-sink bits - Correct angles and depths for counter-sinking **Theories:** - Function and applications of counter-sinker holes - When to apply counter-sinking in mechanical design **Circumstantial Knowledge:** - Safety precautions while using counter-sink tools - How counter-sinking affects hole and material integrity	- Bench drilling machine - Measuring tools (Vernier caliper) - Workbench -Scribers. -Centre punch. - Counter boring bit - Vernier caliper. - Measuring tape. - Ball pein hammer - Machine vice. - Try square. - Sleeves. Chuck and chuck key - Safety boots - Overalls - Goggles - Groves

		(c) Counter-boring a drilled hole	**Brainstorming**: Guide the students to think about using a counter-bore bit to enlarge a drilled hole **Think-Ink-Pair-Share**: Guide the students to discuss the proper machine settings and measurements for counter-boring **Interactive Simulation**: Guide the students through performing counter-boring with the correct settings **Class Activities**: Have students practise counter-boring with proper settings and measurements	The student must be able to: • Use a counter-bore bit to enlarge the bottom of a drilled hole accurately • Set up the machine correctly for counter-boring • Ensure proper measurements are taken during the counter-boring process	Counter-bored holes meet dimensional requirements (depth, diameter, and alignment)	**Knowledge Evidence:** Detailed knowledge of: - Counter-boring procedures - Selection of correct counter-bore bit size **Principles:** - Importance of proper counter-boring depth and diameter - Matching counter-bore bit to hole diameter **Theories:** - How counter-boring differs from counter-sinking - Applications of counter-boring in various mechanical operations **Circumstantial Knowledge:** - Safety protocols when using counter-boring tools - How to adjust feed and speed for counter-boring	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Counter-bore bits - Bench drilling machine - Measuring tools (Vernier caliper) - Workbench Vernier caliper. - Measuring tape. - Ball pein hammer - Machine vice. - Try square. - Sleeves. Chuck and chuck key - Safety boots - Overalls - Goggles - Leather Groves	
	3.8 Manual Thread Cutting	(a) Tapping a drilled hole	**Demonstration:** Show the process of tapping a drilled hole using the appropriate tap and	The student should be able to: Interpret technical drawings – Select suitable	Tapped hole is accurate and conforms to technical standards for	**Knowledge Evidence:** Detailed knowledge of: - Thread cutting	This element can be achieved at a work place or in a training institution. The following tools,	106

			wrench **Practical Exercise:** Let the students practise tapping holes of different sizes **Group Discussion:** Discuss the differences between external and internal threads	material – Select the correct taps and drill sizes – Mark the workpiece for drilling – Clamp the workpiece securely – Determine the correct tapping direction – Drill and chamfer the hole to the specified size – Perform internal threading using taps. – Check the accuracy and quality of the threads. – Clean the tools and work area after completion. – Store machines and tools safely and securely.	thread size and alignment.	procedures - Tapping and threading methods **Principles:** - Tap and die operation sequencing - Measurement techniques for thread cutting - Tap drill size (TDS) calculations **Theories:** - Function and types of threads - Types of taps and dies - Applications of external and internal threading **Circumstantial Knowledge:** - Safety procedures for tapping and cutting threads - Best practices for ensuring thread accuracy	equipment and safety gears should be available:- - Centre punch - Hammer - Prick punch - Scriber - Tap wrench - Set of taps and dies - Bench vice - Try square - Cutting oil - Oil can - Drill bit - Drill machine - Vernier caliper - Safety goggles - Leather gloves - Overalls - Safety boots	
		(b) Cutting external threads by die and stock	**Demonstration:** Show the procedure for using a die and stock to cut external threads **Practical Exercise:** Let the students practise cutting	The student should be able to: - Interpret technical drawings to determine thread specifications - Select suitable materials for	External threads meet required technical specifications for size, pitch, and finish	**Knowledge Evidence:** Detailed knowledge of: - External threading techniques - Tools used for	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:-	

			external threads on work pieces **Group Discussion:** Discuss the importance of selecting the correct die size and cutting direction	threading - Choose the correct dies for thread size and pitch - Mark the work piece for proper alignment - Secure the work piece firmly in a bench vice or suitable fixture -Use die and stock to cut external threads to specification - Check the accuracy of threads using a thread gauge - Clean tools, machines, and the work area after use - Safely store tools and equipment		external thread cutting (die, stock, etc.) **Principles:** - Cutting external threads using dies - Proper sequence of operations when using dies **Theories:** - Types of dies and their applications - Thread pitch and its relationship with die sizes **Circumstantial Knowledge:** - Safety measures for external thread cutting - Proper handling of dies and stocks	- Die and stock set - Thread gauge - Bench vice - Cutting oil - Oil can - Safety boots - Overalls - Leather gloves - Vernier caliper	
4.0 Performing Sheet Metal Work	4.1 Performing Hand Shearing	(a) Performing straight shearing	**Demonstration:** Show how to perform straight shearing using tin snips **Practical Exercise:** Let the students practise straight shearing on different metals **Discussion:** Explain factors that influence straight cuts, such as	The student should be able to: - Interpret working drawings - Take correct measurements - Select recommended tin snip for the job - Clamp work piece firmly - Make calculations - Cut specified sheet metal	The sheared metal has clean, straight edges and conforms to technical specifications	**Knowledge Evidence:** Detailed knowledge of: - Shearing techniques for straight cuts - Measurement methods for accurate cuts **Principles:** - Mechanics of shearing using tin snips	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Working drawings - Hand shearing tools - Measuring tape - Straight edge - Scriber	65

			material type and snip quality	- Clean machine and tools - Clean workplace - Store tools safely		- Proper handling and operation of snips **Theories:** - Types of metals and their suitability for shearing -Characteristics of different tin snips (e.g., straight snips, left-cut, right-cut) **Circumstantial Knowledge:** - Safety precautions during shearing - Operational procedures for straight shearing	- Workbench - Clamps - Safety boots - Leather gloves - Overalls - Centre punch - Ball peen hammer	
		(b) Performing circular shearing	**Demonstration:** Show how to use tin snips to perform circular cuts on sheet metal **Practical Exercise:** Let the students practise cutting circular shapes and arcs **Discussion:** Explain the importance of using the correct snip for curved cutting and the effect of tool wear on accuracy	The student should be able to: - Interpret working drawings - Take correct measurements - Select the recommended tin snip for the job - Clamp workpiece firmly - Make calculations - Cut specified sheet metal - Clean machine and tools - Clean workplace - Store tools safely	The sheared metal has smooth and accurate curved edges that meet technical specifications	**Knowledge Evidence:** Detailed knowledge of: - Circular shearing techniques - Types of tin snips suited for curved cutting **Principles:** - Handling tin snips for precision circular cuts - Factors influencing cut quality, such as blade sharpness **Theories:** - Properties of	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- -Tin snips for curved cuts - Measuring tape - Protractor - Divider - Scriber - Workbench - Clamps - Safety boots - Leather gloves	

						metals influencing circular cutting - Techniques for avoiding distortions during curved cuts **Circumstantial Knowledge:** - Safety precautions during circular shearing - Proper cleaning and maintenance of tin snips	- Overalls - Straight edge - Soft hammer	
	4.2 Machine shearing	(a) Performing straight shearing	**Demonstration:** Show how to operate a shearing machine to cut straight metal sheets **Practical Exercise:** Let the students practise using a shearing machine on different metals **Discussion:** Explain key factors influencing straight cuts, such as blade sharpness and material type	The student should be able to: - Interpret working drawings - Select suitable material and size - Take correct measurements - Check the sharpness and tightness of the blade - Select the appropriate die and punch for the job - Select the appropriate machine - Fit the die and punch to the machine - Mark out the work piece to be cropped or punched - Safely grip the	The sheared workpiece conforms to technical specifications with clean edges	**Knowledge Evidence:** Detailed knowledge of: - Shearing techniques for straight cuts - Measurement methods for accurate cuts **Principles:** - Shearing and cropping methods and machine setup - Safe handling of machines and materials **Theories:** - Properties of metals and how they respond to shearing - Types of shearing machines, dies, and punches - Techniques for	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Working drawings - Shearing machine - Crop and punching machine - Bench shear - Measuring tape - Try square - Scriber - Workbench - Centre punch - Ball peen hammer - Leather gloves - Leather apron - Safety boots - Steel ruler - Soft hammer	64

			workpiece with the stripper - Work in correct position - Cut the metal - Punch or crop the workpiece - Check accuracy - File the sharp edges - Clean tools and work place - Store tools safely		selecting appropriate tooling **Circumstantial Knowledge:** - Safety precautions while operating shearing, cropping, and punching machines - Correct positioning and machine operation for optimal results		
	(b) Performing metal notching	**Brainstorming**: Guide the students to think about using a machine for notching metal **Think-Ink-Pair-Share**: Guide the students to discuss the importance of accurate notching and its impact on the final product **Interactive Simulation**: Guide the students through practicing metal notching on sheet metals **Class Activities**: Have the students practise metal notching on various sheet metals	The student should be able to: - Interpret working drawings - Select suitable material and size - Take correct measurements - Check sharpness and tightness of blade - Select appropriate die and punch for the job - Select appropriate machine - Fit the die and punch to the machine - Mark out the work piece to be cropped or punched - Safely grip the work piece with the stripper	The notched metal conforms to the technical specifications with precise edges and correct positioning	**Knowledge Evidence:** Detailed knowledge of: - Notching techniques using machine tools - Metal types and their suitability for notching **Principles:** - Machine setup for notching - Adjusting machine for precision and accuracy **Theories:** - Understanding notching tools, their parts, and their functions - Calculations for determining proper notching position - The effect of	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Notching machine - Measuring tape - Workbench - Centre punch - Steel ruler - Try square - Scriber - Safety boots - Leather gloves - Overalls	

		- Work in correct position - Cut the metal - Punch or crop the work piece - Check accuracy - File the sharp edges - Clean tools and work place - Store tools safely		metal properties on the quality of notching	
(c) Cropping an angle iron	**Demonstration:** Show how to set up the machine for cropping angle iron **Practical Exercise:** Allow the students to practise cropping angle iron and check for clean cuts **Discussion:** Discuss the challenges of cropping angle iron compared to flat sheet metal, such as positioning and strength	The student should be able to: - Select suitable material and size - Take correct measurements - Check sharpness and tightness of blade - Select appropriate die and punch for the job - Fit the die and punch to the machine - Mark out the work piece to be cropped or punched - Safely grip the workpiece with the stripper - Cut the metal - Punch or crop the workpiece - Check accuracy - Clean tools and work place - Store tools safely	The cropped angle iron conforms to the technical specifications with smooth, accurate edges	**Knowledge Evidence:** Detailed knowledge of: - Cropping angle iron using shearing machines - How to select the correct angle iron for the task **Principles:** - Cropping techniques for angle iron - Correct machine settings for angle iron cropping **Theories:** - Characteristics of angle iron and its effect on shearing performance - Measuring methods for angle iron cropping	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Angle iron - Shearing machine - Measuring tape - Steel ruler - Centre punch - Leather gloves - Overalls - Safety boots

		(d) Punching holes on a plate	**Demonstration:** Show how to use the punching machine to create holes in a metal plate **Practical Exercise:** Let students practise punching holes in plates with different hole sizes **Discussion:** Discuss the importance of hole size, placement, and safety considerations during punching	The student should be able to: - Select suitable material and size - Take correct measurements - Check sharpness and tightness of blade - Select appropriate die and punch for the job - Select appropriate machine - Fit the die and punch to the machine - Mark out the work piece to be cropped or punched - Safely grip the workpiece with the stripper - Work in correct position - Cut the metal - Punch or crop the workpiece - Clean tools and work place - Store tools safely	The punched holes meet the specified dimensions and are clean without deformation	**Knowledge Evidence:** Detailed knowledge of: - Punching techniques for creating holes - Punch and die selection for hole creation **Principles:** - Punching process and machine setup - Safety precautions when using punching machines **Theories:** - Types of punches and their applications - How to calculate the correct hole size and position - Properties of metals affecting hole punching	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Angle iron - Shearing machine - Measuring tape - Steel ruler - Centre punch - Leather gloves - Overalls - Safety boots	
	4.3 Performing chiseling	(a) Cutting thin metal	**Demonstration:** Show how to use different chisels to cut thin metal accurately **Practical Exercise:** Allow the students to practise cutting	The student should be able to: - Select appropriate chisel for the job - Grind chisel cutting edge to correct angle - Mark out the	The cut metal piece conforms to the technical specifications, with smooth edges and accurate dimensions	**Knowledge Evidence:** Detailed knowledge of: - Chiseling techniques used for cutting thin metal	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:-	65

		thin sheet metal using chisels **Discussion:** Discuss the challenges when working with thin metal and the importance of controlling the chisel angle and pressure	outline to be cut - Safely grip the work piece and chisel - Work in correct posture - Cut or clip off metal - Grind off mushrooms (blunt spots) - File the sharp edges - Clean tools and work place - Store tools safely		- Proper chisel handling and selection **Principles:** - The principles of chiseling, material hardness, and cutting angles - Factors influencing chiseling effectiveness and precision **Theories:** - Types of chisels (flat, cross-cut, cape, etc) and their applications - The material composition and hardness of chisels and metals - Chiseling action and techniques **Circumstantial Knowledge:** - Safety precautions when chiseling metal - How to ensure safe handling and prevent accidents during chiseling	- Flat chisel - Cross cut chisel - Cape chisel / Round nose chisel - Diamond point chisel - Side cutting chisel - Hammer - Bench grinder - Vice - File - Safety goggles - Gloves - Safety boots	
	(b) Performing surface chipping	**Demonstration:** Show how to chip metal surfaces to achieve a specific shape or surface finish **Practical Exercise:**	The student should be able to: - Select appropriate chisel for the job - Grind chisel cutting edge to correct angle	The chipped surface conforms to technical specifications, with no visible flaws or deformation	**Knowledge Evidence:** Detailed knowledge of: - Surface chipping techniques for smooth finishes	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should	

			Let the students practise chipping metal surfaces, ensuring that the finished surface meets the required specifications **Discussion:** Explain the difference between chiseling and chipping, focusing on techniques used to chip without damaging the metal	- Mark out the area to be chipped - Safely grip the workpiece and chisel - Work in correct posture - Perform chipping of the surface - Grind off mushrooms (blunt spots) - File the sharp edges - Clean tools and work place - Store tools safely		- Correct chisel handling for surface chipping **Principles:** - Surface chipping techniques - The relationship between chisel angle and surface finish **Theories:** - Types of chisels and their suitability for different chipping applications - Material hardness and how it affects chipping outcomes - Chipping action and methods for achieving smooth surfaces	be available:- - Flat chisel - Cross cut chisel - Cape chisel / Round nose chisel - Diamond point chisel - Side cutting chisel - Hammer - Bench grinder - Vice - File - Safety goggles - Gloves - Safety boots	
	4.4 Forming Sheet metal	(a) Bending sheet metal at right angle	**Demonstration:** Show how to bend sheet metal at right angles using the proper tools **Practical Exercise:** Allow the students to practise bending sheet metal accurately **Discussion:** Discuss how to calculate bending allowances and apply them for precise bending results	The student should be able to: - Identify types of metals - Take correct measurements - Calculate forming allowances using proper formulas - Develop patterns for different bends - Set the work piece into a bending machine - Operate different types of metal forming machines	The formed work piece conforms to the technical specifications for bends, angles, and dimensions	**Knowledge Evidence:** Detailed knowledge of: - Bending techniques used to form metal at right angles - How to calculate bending allowances and adjust according to material thickness **Principles:** - The principles of bending and metal deformation	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Working drawing - Steel ruler - Measuring tape - Divider - Protractor - Try square - Hammers - Scriber - Grooving tool	65

			- Observe safety during the process - Check the accuracy of bent angles - Clean tools and machines - Store tools and equipment safely		- Measuring techniques for angles and dimensions **Theories:** - Types of metals and their properties (ductility, hardness, etc) - Bending machine setup and operations - Understanding bending allowances **Circumstantial Knowledge:** - Safety precautions for working with metal forming machines and tools	- Bending machine - Seaming machines - Cutting machine - Forming tools - Overalls - Safety boots - Leather gloves	
	(b) Forming single and double seam	**Practical Exercise:** Demonstrate how to form both single and double seams in sheet metal **Group Discussion:** Talk about the importance of seam strength and the different methods to create these seams **Practical Work:** Students practise making single and double seams with correct alignment	The student should be able to: - Identify the types of seams required for specific tasks - Take proper measurements for seam alignment - Form single and double seams with correct pressure and alignment - Operate seaming machines - Ensure seams are smooth, even, and secure	The formed seams conform to the technical specifications for strength, width, and evenness	**Knowledge Evidence:** Detailed knowledge of: - Methods for forming single and double seams - Different types of seams and their applications in metalworking **Principles:** - Principles of seam formation (pressure, alignment, and material flow)	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Seaming machines - Working drawing - Measuring tools (ruler, tape measure, etc.) - Divider. -Protractor. -Try square. - Hammers.	

			- Clean the work area and tools after the task - Store tools and equipment safely		**Theories:** - Seam strength and its importance in different sheet metal applications - The function of the seam in finished products **Circumstantial Knowledge:** - Safety measures to follow while forming seams	- Scriber. - Grooving tool. - Bending machine. - Seaming machines. -Cutting machine. - Overalls - Safety boots - Leather gloves
		(c) Forming grooved seam	**Demonstration:** Show how to form grooved seams in sheet metal, using the correct machines and tools **Practical Work:** Allow the students to practise grooved seam forming, ensuring that the depth and alignment meet technical specifications	The student should be able to: - Identify the required groove type for the task - Take accurate measurements to form grooves - Set up the grooving machine and ensure proper alignment - Form grooved seams without damaging the workpiece - Inspect groove depth and finish for accuracy - Clean tools and work area after forming - Store tools and equipment safely	The grooved seams meet technical specifications, with correct depth and alignment	**Knowledge Evidence:** Detailed knowledge of: - How to form grooved seams using the correct machines - Calculating groove depth and alignment **Principles:** - The principles of grooving and how it affects material strength - Proper setup and operation of grooving machines **Theories:** - Types of grooves (V-grooves, U-grooves, etc) and their application in metal forming - Grooving machine functions	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Grooving tools - Grooving machine - Measuring tools - Overalls - Safety boots - Leather gloves

						and parts **Circumstantial Knowledge:** - Safety procedures for operating grooving machines	
		(d) Forming cylindrical shapes	**Demonstration:** Show how to form cylindrical shapes from sheet metal **Practical Exercise:** Let the students practise rolling or forming metal sheets into cylindrical shapes, ensuring proper dimensions and consistency	The student should be able to: - Identify the proper metal for cylindrical forming - Take accurate measurements for cylindrical dimensions - Set the workpiece into the forming machine - Form cylindrical shapes without deforming the material - Check the alignment and consistency of the cylinder - Clean tools and work area - Safely store tools and machines after use	The cylindrical shapes formed conform to technical specifications in diameter, smoothness, and alignment	**Knowledge Evidence:** Detailed knowledge of: - Methods for forming cylindrical shapes from sheet metal - The importance of maintaining consistent pressure and alignment **Principles:** - The principles of cylindrical forming - The impact of metal type and thickness on the forming process **Theories:** - Methods used for cylindrical forming (rolling, crimping, etc) - Types of forming machines used for cylindrical shapes **Circumstantial Knowledge:** - Safety precautions when working with	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Shearing machine - Forming tools - Rolling machine - Measuring tools - Overalls - Safety boots - Leather gloves	

					cylindrical forming machines		
4.5 Soft soldering	(a) Joining metal sheets by soldering	**Demonstration:** Show the correct soldering technique to join metal sheets, explaining the different materials and tools used **Practical Work:** Allow the students to practice joining metal sheets using a soldering iron/gun **Discussion:** Highlight the importance of cleanliness and heat control in the soldering process	The student should be able to: - Select the appropriate soldering material and flux - Prepare the workpiece by cleaning it properly - Apply flux and use a soldering gun/iron to heat the metal - Maintain the correct soldering temperature and technique - Inspect the seam for proper bonding - Remove any flux residues - Safely store tools and clean the work area	The soldered joint should meet technical specifications, with clean seams and no visible defects	**Knowledge Evidence:** Detailed knowledge of: - Soft soldering techniques used for joining metals - Tinning and curing processes in soldering **Principles:** - Principles of soft soldering, including the effects of heat and flux on metal bonding **Theories:** - Chemical composition of solder and flux, and their impact on the joining process - Soldering temperatures and their influence on the quality of the bond	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Soldering gun/iron - Workbench - Snips - Wire brush - Grip pliers - Measuring tape - Scriber - Goggles - Leather gloves - Leather apron - Safety boots - Canvas spats	65
	(b) Joining pipe pieces by soldering	**Demonstration:** Show the process of soldering pipe pieces together, explaining the steps to ensure a strong joint **Practical Work:** Allow the students	The student should be able to: - Properly clean and prepare the pipe surfaces - Apply flux to the joint and heat it evenly using the soldering gun/iron	The pipe joints should be properly soldered, with no gaps, leaks, or visible defects, conforming to technical specifications	**Knowledge Evidence:** Detailed knowledge of: - Techniques for joining pipe pieces by soldering - Different solder types for pipe	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Soldering gun/iron	

			to practise joining pipe pieces by soldering, maintaining correct heat and alignment **Discussion:** Discuss the different considerations when soldering pipes, such as pipe size and solder type	- Use the correct soldering filler wire for pipe joining - Inspect the pipe joint for proper bonding and absence of leaks - Remove flux residue and clean up the work area		work **Principles:** - Understanding of the heat requirements and flux use for joining pipes **Theories:** - Soldering processes and the different temperatures required for soldering pipes	- Pipe pieces - Soldering filler wire - Flux - Measuring tape - Pipe cutter -Pipe flear - Leather gloves - Goggles - Safety boots - Leather apron	
	4.6 Riveting	(a) Joining thick plates by hot riveting	**Demonstration:** Show the process of hot riveting, including heating the rivets and joining thick plates **Practical Work:** Allow students to practise hot riveting, emphasizing the correct heating and handling techniques **Discussion:** Discuss the importance of rivet size and alignment for strong joints	The student should be able to: - Prepare the metal plates and heat the rivets - Align the metal plates and drill holes with the correct clearance - Use suitable tools to perform hot riveting - Inspect the rivet joint for defects - Clean the tools and work area, and safely store the equipment	Riveted joints should be strong, aligned, and free of defects, conforming to technical specifications	**Knowledge Evidence:** Detailed knowledge of: - Hot riveting techniques and their application - Principles of heating and expanding rivets for thick plates **Principles:** - Operating riveting tools and equipment - Importance of precise measurements and clearances in riveting **Theories:** - Interpretation of working drawings and understanding rivet types and sizes	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Riveting tools: hammer, doll, rivet set, rivet head - Drilling machine - Drill bits - Measuring tools: tape, scriber, try square - blow lamp - Safety gear: goggles, gloves, apron, boots, ear plugs	65

					- Calculation of hole clearances and alignment techniques		
	(b) Joining thin sheets by cold riveting	**Demonstration:** Show the process of cold riveting for thin sheets, focusing on proper drilling and alignment **Practical Work:** Students practise cold riveting, ensuring precise drilling and riveting techniques **Discussion:** Discuss common defects in cold riveting and how to avoid them	The student should be able to: - Select appropriate rivets and drill bits for thin sheets - Drill and align holes accurately - Use the correct riveting tools for cold riveting - Inspect the riveted joints for proper bonding and defects	Riveted thin sheets should be securely joined with no visible defects, meeting technical specifications	**Knowledge Evidence:** Detailed knowledge of: - Cold riveting techniques and their application to thin sheets - Tools and equipment for cold riveting **Principles:** - Importance of alignment and precise drilling for effective cold riveting **Theories:** - Understanding the differences between hot and cold riveting techniques	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Cold riveting tools: pop riveting gun, bench vice, drill bits - Safety equipment: gloves, goggles, apron, boots - Measuring and marking tools	
4.7 Grinding	(a) Grinding weld seams	**Demonstration:** Show the process of grinding weld seams, including selecting the appropriate grinding wheel and technique **Practical Work:** Allow the students to practice grinding weld seams, focusing on	The student should be able to: - Select and install the correct grinding wheel - Adjust wheel guards and work rests properly - Hold and grind the workpiece accurately - Inspect the finished weld	Weld seams should be smooth, free of burrs, and conform to technical specifications	**Knowledge Evidence:** Detailed knowledge of: - Grinding techniques for weld seams - Principles of wheel dressing and adjusting work rests **Principles:** - Safe operation of	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Pedestal grinder - Angle grinder - Grinding wheels of different grades - Safety gear:	64

			accuracy and safety **Discussion:** Discuss the importance of smooth weld seams for structural integrity and aesthetics	seams for smoothness and conformity to specifications - Clean and store tools and machines safely		grinding machines - Importance of selecting the right abrasive material **Theories:** - Different grades of grinding wheels and their applications - The importance of grooving and sharpening metals - Adjustment of wheel guard and work rest	goggles, apron, boots, dust mask, ear plugs	
		(b) Grinding weld joints	**Demonstration:** Show the process of grinding weld joints for smooth and strong connections **Practical Work:** Students practise grinding weld joints, ensuring proper technique and safety measures are followed **Discussion:** Discuss how grinding enhances weld joint strength and prevents defects	The student should be able to: - Adjust and secure the grinding machine for weld joint grinding - Select appropriate grinding wheels for the task - Grind the weld joints smoothly and safely - Inspect the weld joints for quality and accuracy	Weld joints should be smooth, accurately ground, and meet the technical specifications	**Knowledge Evidence:** Detailed knowledge of: - Grinding techniques for weld joints - Principles of adjusting work rests and wheel guards **Principles:** - Importance of wheel dressing and selecting appropriate abrasives **Theories:** - Understanding the impact of proper grinding on weld joint strength and appearance	This element can be achieved at a work place or in a training institution. The following tools, equipment and safety gears should be available:- - Bench grinder - Safety gear: goggles, gloves, apron, boots - Grinding accessories	
		(c) Sharpening cutting tools	**Demonstration:** Show the process	The student should be able to:	Cutting tools should be	**Knowledge Evidence:**	This element can be achieved at a work	

			of sharpening cutting tools using a bench grinder, focusing on correct angles and techniques **Practical Work:** Students practise sharpening various cutting tools, such as chisels and drill bits **Discussion:** Discuss the importance of sharp tools for effective and precise work	- Install and adjust the grinding wheel for tool sharpening - Grind cutting tools to the correct angle - Inspect and test the sharpness of the tools - Clean and maintain the grinding machine and tools	sharpened to the correct angle and free of defects, meeting technical specifications	Detailed knowledge of: - Techniques for sharpening various cutting tools **Principles:** - Safe operation of grinding machines for sharpening tasks **Theories:** - Understanding abrasive selection and its impact on sharpening effectiveness	place or in a training institution. The following tools, equipment and safety gears should be available:- - Bench grinder - Twist drill, chisel, centre punch - Safety equipment: goggles, gloves, apron, boots	

Form Two

Table 4*: Detailed Contents for Form Two*

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
1. Performing shielded metal arc welding and arc cutting	1.1. Carrying out mild steel arc welding	(a)Using of tools and equipment Welding straight beads	**Brainstorming**: Guide the students to identify tools and equipment used in welding and explain the basic arc welding bead **Think-Ink-Pair-Share**: Guide the students to talk about how to do arc welding bead **Interactive Simulation**: Guide the students to practice doing arc welding bead **Class Activities**: Organize the students into groups to do arc welding on different materials	Inspect the machine, cable and electrode holder Interpret working drawing Prepare materials for welding Select type and size of electrode for the job Set recommended current Weld a work piece Maintain electrode angle and arc length Control electrode	Straight Welded metal beads conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the uses of tools and equipment and welding technique used **Principles:** The student should explain the principles of: • Welding straight beads •Minimizing distortion •Selecting weld current **Theories:** The student should explain: • Types and functions of	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • DC/AC Welding machines • Welding cables • Electrode holder • Welding shield • Chipping hammer • Wire brush • Welding Workbench • Welding tongs • Angle grinder • Flat file • Bench vice • Scriber • Earth clamp • Ball peen	110

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	**Service Assessment**	**Knowledge Assessment**		
				travel speed along the joint Chip off metal slag and wire brush Inspect for weld defect Clean work place Clean tools and equipment Store tools and equipment in safe place		welding equipment • Types of metals and their properties • Types and classification of electrodes • Uses of wire brush and chipping hammer • Characteristics of AC and DC welding machine • Types of electrode coatings and function • Work angle and lead angle • Welding symbols • Types of distortion **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while welding straight beads • Welding bead techniques	hammer • Centre punch • Tongs • Overalls • Leather gloves • Canvas spats • Safety boots • Leather apron • Centre punch, Overalls.	
		(b). Welding	**Brainstorming**:	Inspect the	Welded metal in	**Knowledge Evidence**	This element can be	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
		metal in down hand butt joint in 1G Position	Guide the students to identify tools and equipment used in welding a metal butt joint in the 1G position **Think-Ink-Pair-Share**: Guide the students to discuss how to perform a butt joint weld in the 1G position **Interactive Simulation**: Guide the students through welding a butt joint in the 1G position with different materials **Class Activities**: Organize the students into groups to practice welding a butt joint in the 1G position on	machine, cable and electrode holder Interpret working drawing Prepare materials for down-hand butt joint in 1G position Select the type and size of electrode for the job Set recommended current Weld a work piece in down hand butt joint in 1G Position Maintain electrode angle and arc length Control electrode travel speed along the joint Chip off metal slag and wire brush	down hand butt joint in 1G Position conforms to technical specifications	**Detailed knowledge of:** **Method used:** The student should explain the uses of tools and equipment and welding technique used **Principles:** The student should explain the principles of: •Welding metal in down hand butt joint in 1G Position •Minimizing distortion •Obtaining good penetration •Selecting weld current **Theories:** The student should explain: • Types of metals and their properties • Types and classification of electrodes • Types of weld positions	achieved at a workplace or training institution. The following tools, equipment, and safety gear are to be available • DC/AC Welding machines • Welding cables • Electrode holder • Welding shield. • Chipping hammer • Wire brush • Welding Workbench • Welding tongs • Angle grinder • Flat file • Bench vice • Scriber • Earth clamp • Ball-pein hammer • Centre punch • Tongs • Overalls • Leather gloves • Canvas spats • Safety boots • Leather apron • Centre punch	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			various materials	Inspect for weld defect Clean work place Clean tools and equipment Store tools and equipment in safe place		according to International standards • Types of butt welds • Work angle and lead angle • Welding symbols • Types of distortion • Joint design **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while welding work piece • Welding metal in down hand butt joint in 1G Position techniques	Overalls	
		(c). Welding metal in down hand lap joint 1F position	**Brainstorm:** Guide the students to identify relevant tools and equipment used in welding metal down hand lap	Inspect the machine, cable and electrode holder Interpret working drawing Prepare materials for down hand lap	Welded metal in down hand lap joint 1F position conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • DC/AC Welding	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			joint 1F position **Practical work:** Guide the student on how to perform down hand lap joint 1F position **Activity:** Organize students in manageable groups to perform down hand lap joint 1F position arc welding for different materials	joint 1F position Select type and size of electrode for the job Set recommended current Weld a work piece in down hand lap joint 1F position Maintain electrode angle and arc length Control electrode travel speed along the joint Chip off metal slag and wire brush Inspect for weld defect Clean work place Clean tools and equipment Store tools and		technique used in welding metal down hand lap joint 1F position **Principles:** The student should explain the principles of: •Welding metal in down hand lap joint 1F position •Minimizing distortion •Obtaining good penetration •Selecting weld current **Theories:** The student should explain: • Types of metals and their properties • Types and classification of electrodes • Types of weld positions according to International standards	machines • Welding cables • Electrode holder • Welding shield • Chipping hammer • Wire brush • Welding Workbench • Welding tongs • Angle grinder • Flat file • Bench vice • Scriber • Earth clamp • Ball peen hammer • Centre punch • Tongs • Overalls • Leather gloves • Canvas spats • Safety boots • Leather apron • Centre punch	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
				equipment in safe place		• Types of lap welds • Work angle and lead angle • Welding symbols • Types of distortion • Joint design **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while welding work piece down hand lap joint 1F position • Welding metal in down hand lap joint 1F position techniques		
		(d). Welding metal in down hand corner joint 3G position	**Brainstorm:** Guide the students to define, explain down hand corner joint 3G position	Inspect the machine, cable and electrode holder Interpret working drawing	Welded metal in hand corner joint 3G position conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:**	This element can be achieved at a work place or training institution. The following tools, equipment, and	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			Practical work: Guide the student on how to perform down hand corner joint 3G position **Activity:** Organize the students in manageable groups to perform down hand corner joint 3G position welding for different materials	Prepare materials for down hand corner joint 3G position Select type and size of electrode for the job Set recommended current Weld a work piece in down hand corner joint 3G position Maintain electrode angle and arc length Control electrode travel speed along the joint Chip off metal slag and wire brush Inspect for weld defect Clean work place		**Method used:** The student should explain the technique used in welding metal down hand corner joint 3G position **Principles:** The student should explain the principles of: •Welding metal in down hand corner joint 3G position •Minimizing distortion •Obtaining good penetration •Selecting weld current **Theories:** The student should explain: • Types of metals and their properties • Types and	safety gear are to be available • DC/AC Welding machines • Welding cables • Electrode holder • Welding shield • Chipping hammer • Wire brush • Welding Workbench • Welding tongs • Angle grinder • Flat file • Bench vice • Scriber • Earth clamp • Ball pein hammer • Centre punch • Tongs • Overalls • Leather gloves • Canvas spats • Safety boots • Leather apron • Centre punch	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
				Clean tools and equipment Store tools and equipment in safe place		classification of electrodes • Types of weld positions according to International standards • Types of lap welds • Work angle and lead angle • Welding symbols • Types of distortion **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while welding work piece down hand corner joint 3G position • Welding metal in down hand		

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
						corner joint 3G position techniques		
		(e). Welding metal in down hand tee joint in 1F position	**Brainstorming**: Guide the students to define and explain the down-hand tee joint in the 1F position **Think-Ink-Pair-Share**: Guide the students to discuss how to perform a down-hand tee joint in the 1F position **Interactive Simulation**: Guide the students through performing the down-hand tee joint in the 1F position **Class Activities**: Organize the students into groups to practice welding a down-hand tee joint in the 1F position on different	Inspect the machine, cable and electrode holder Interpret working drawing Prepare materials for down hand tee joint in 1F position Select type and size of electrode for the job Set recommended current Weld a work piece in down hand tee joint in 1F position Maintain electrode angle and arc length Control electrode travel speed along the joint	Welded metal in down hand tee joint in 1F position conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the technique used in welding metal down hand tee joint in 1F position **Principles:** The student should explain the principles of: •Welding metal in down hand tee joint in 1F position •Minimizing distortion •Obtaining good penetration •Selecting weld current **Theories:** The student should explain:	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • DC/AC Welding machines • Welding cables • Electrode holder • Welding shield • Chipping hammer • Wire brush • Welding Workbench • Welding tongs • Angle grinder • Flat file • Bench vice • Scriber • Earth clamp • Ball pein hammer • Centre punch • Tongs • Overalls	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			materials Chip off metal slag and wire brush Inspect for weld defect Clean work place Clean tools and equipment Store tools and equipment in safe place			• Types of metals and their properties • Types and classification of electrodes • Types of weld positions according to International standards • Work angle and lead angle • Welding symbols • Types of distortion **Circumstantial knowledge:** **Detailed knowledge about:** Safety precautions to be observed while welding work piece down hand tee joint in 1F position • Welding metal in down hand tee joint in 1F position techniques	• Leather gloves • Canvas spats • Safety boots. • Leather apron • Centre punch	
		(f). Welding metal in	**Brainstorm:** Guide the students to	Inspect the machine, cable and electrode holder	Welded metal in horizontal butt	**Knowledge Evidence**	This element can be achieved at a work	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
		horizontal butt joint in 2G position	define, explain welding metal in horizontal butt joint in 2G position **Practical work:** Guide the student on how to perform welding metal in horizontal butt joint in 2G position **Activity:** Organize students in manageable groups to perform welding metal in horizontal butt joint in 2G position for different materials	Interpret working drawing Prepare materials for horizontal butt joint in 2G position Select type and size of electrode for the job Set recommended current Weld a work piece in horizontal butt joint in 2G position Maintain electrode angle and arc length Control electrode travel speed along the joint Chip off metal slag and wire brush Inspect for weld defect Clean work place Clean tools and equipment	joint in 2G position conforms to technical specifications	**Detailed knowledge of:** **Method used:** The student should explain the technique used in welding metal in horizontal butt joint in 2G position **Principles:** The student should explain the principles of: •Welding metal in horizontal butt joint in 2G position •Minimizing distortion •Obtaining good penetration •Selecting weld current **Theories:** The student should explain: • Types of metals and their properties • Types and classification of	place or training institution. The following tools, equipment, and safety gear are to be available: • DC/AC Welding machines • Welding cables • Electrode holder • Welding shield • Chipping hammer • Wire brush • Welding Workbench • Welding tongs • Angle grinder • Flat file • Bench vice • Scriber • Earth clamp • Ball peen hammer • Centre punch • Tongs • Overalls • Leather gloves • Canvas spats • Safety boots • Leather apron • Centre punch	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
				Store tools and equipment in safe place		electrodes • Types of weld positions according to International standards • Work angle and lead angle • Welding symbols • Types of distortion **Circumstantial knowledge:** **Detailed knowledge about:** Safety precautions to be observed while welding work piece in horizontal butt joint in 2G position • Welding metal in horizontal butt joint in 2G position techniques		
		(g). Welding metal in horizontal corner joint in 2F position	**Brainstorm:** Guide the students to define, explain welding metal in horizontal corner joint in 2F position **Practical work:**	Inspect the machine, cable and electrode holder Interpret working drawing Prepare materials for horizontal	Welded metal in horizontal corner joint in 2F position conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available:	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			Guide the student on how to perform welding metal in horizontal corner joint in 2F position **Activity:** Organize students in manageable groups to perform welding metal in horizontal corner joint in 2F position for different materials	corner joint in 2F position Select type and size of electrode for the job Set recommended current Weld a work piece in horizontal corner joint in 2F position Maintain electrode angle and arc length Control electrode travel speed along the joint Chip off metal slag and wire brush Inspect for weld defect Clean work place Clean tools and equipment Store tools and equipment in safe place		student should explain the technique used in welding metal horizontal conner joint in 2F position **Principles:** The student should explain the principles of: •Welding metal in horizontal conner joint in 2F position Minimizing distortion •Obtaining good penetration •Selecting weld current **Theories:** The student should explain: • Types of metals and their properties • Types and classification of electrodes • Work angle and lead angle • Welding symbols • Types of distortion **Circumstantial**	• DC/AC Welding machines • Welding cables • Electrode holder • Welding shield • Chipping hammer • Wire brush • Welding Workbench • Welding tongs • Angle grinder • Flat file • Bench vice • Scriber • Earth clamp • Ball pein hammer • Centre punch • Tongs • Overalls • Leather gloves • Canvas spats • Safety boots • Leather apron • Centre punch	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
						knowledge: **Detailed knowledge about:** Safety precautions to be observed while welding work piece horizontal conner joint in 2F position • Welding metal in in horizontal conner joint in 2F position techniques		
		(h). Welding metal in horizontal lap joint in 2F position	**Brainstorm:** Guide the students to define, explain welding metal in horizontal lap joint in 2F position **Practical work:** Guide the student on how to perform welding metal in horizontal lap joint in 2F position **Activity:** Organize the students in manageable	Inspect the machine, cable and electrode holder Interpret working drawing Prepare materials for horizontal lap joint in 2F position Select type and size of electrode for the job Set recommended current Weld a work piece in horizontal lap joint in 2F position	Welded metal in horizontal lap joint in 2F position conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the technique used in welding metal horizontal lap joint in 2F position **Principles:** The student should explain the principles of: •Welding metal in	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available: • DC/AC Welding machines • Welding cables • Electrode holder • Welding shield • Chipping hammer • Wire brush • Welding Workbench	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			groups to perform welding metal in horizontal lap joint in 2F position for different materials	Maintain electrode angle and arc length Control electrode travel speed along the joint Chip off metal slag and wire brush Inspect for weld defect Clean work place Clean tools and equipment Store tools and equipment in safe place		horizontal lap joint in 2F position Minimizing distortion **Theories:** The student should explain: • Types of metals and their properties • Types and classification of electrodes • Work angle and lead angle • Welding symbols **Circumstantial knowledge:** **Detailed knowledge about:** Safety precautions to be observed while welding work piece horizontal lap joint in 2F position • Welding metal in in horizontal lap joint in 2F position techniques	• Welding tongs • Angle grinder • Flat file • Bench vice • Scriber • Earth clamp • Ball pein hammer • Centre punch • Tongs • Overalls • Leather gloves • Canvas spats • Safety boots • Leather apron • Centre punch	
		(i). Welding metal in horizontal corner joint in 2G	**Brainstorming**: Guide the students to define and explain welding metal in	Inspect the machine, cable and electrode holder	Welded metal in horizontal corner joint in 2G position	**Knowledge Evidence**	This element can be achieved at a work place or training institution.	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
		position	a horizontal corner joint in the 2G position **Think-Ink-Pair-Share**: Guide the students to discuss how to perform welding in a horizontal corner joint in the 2G position **Interactive Simulation**: Guide students through welding metal in a horizontal corner joint in the 2G position **Class Activities**: Organize students into groups to practice welding in the 2G position on different materials	Interpret working drawing Prepare materials for horizontal corner joint in 2G position Select type and size of electrode for the job Set recommended current Weld a work piece in horizontal corner joint in 2G position Maintain electrode angle and arc length Control electrode travel speed along the joint Chip off metal slag and wire brush Inspect for weld defect Clean work place Clean tools and equipment	conforms to technical specifications	**Detailed knowledge of:** **Method used:** The student should explain the technique used in welding metal horizontal corner joint in 2G position **Principles:** The student should explain the principles of: •Welding metal in horizontal corner joint in 2G position Minimizing distortion •Obtaining good penetration •Selecting weld current **Theories:** The student should explain: • Types of metals and their properties • Types and classification of	The following tools, equipment and safety gear are to be available: • DC/AC Welding machines • Welding cables. • Electrode holder • Welding shield • Chipping hammer • Wire brush • Welding Workbench • Welding tongs • Angle grinder • Flat file • Bench vice • Scriber • Earth clamp • Ball pein hammer • Centre punch • Tongs • Overalls • Leather gloves • Canvas spats • Safety boots • Leather apron • Centre punch	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
				Store tools and equipment in safe place		electrodes • Types of weld positions according to International standards • Work angle and lead angle **Circumstantial knowledge:** **Detailed knowledge about:** Safety precautions to be observed while welding work piece horizontal corner joint in 2G position • Welding metal in in horizontal corner joint in 2G position techniques		
	1.2. Carrying out mild steel arc cutting	(a). Cut thick metals	**Brainstorm:** Guide the students to define, explain mild steel arc cutting **Practical work:** Guide the student on how to perform mild steel arc cutting	**The students should be able to:** Inspect the machine, cable and electrode holder Interpret working drawing Set recommended current and arc	A cutwork piece conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain cutting technique used **Principles:** The student should	This element can be achieved at a work place or training institution. The following tools, equipment and safety gear are to be available: • AC/DC Welding machine	**70**

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			Activity: Organize the students in manageable groups to perform mild steel arc cutting for different materials thickness	flow pressure Choose correct electrode for the job Cut work piece with electrode Control electrode travel speed along the cut Clean the oxides along the kerf Clean the equipment, tools and work place Store the equipment and tools in safe place		explain the principles of: • Cutting by arc without pressurized air • Taking measurements **Theories:** The student should explain: • Parts and functions of cutting equipment • Metallurgical effect during cutting **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while cutting work piece by arc • Metallurgical effect	• Welding cables • Electrode holder • Gouging torch • Welding shield • Chipping hammer • Wire brush • Work bench • Welding tongs • Angle grinder • Flat file • Bench vice • Scriber • Earth clamp • Ball-pein hammer. • Centre punch • Tongs • Overalls • Goggles • Leather gloves • Canvas spats • Safety boots. Leather apron.	
		(b). Gouge metal plates	**Brainstorm:** Guide the students to define, explain	**The student should be able to:** Inspect the	A Gouge metal plate conforms to technical	**Knowledge Evidence** **Detailed knowledge of:**	This element can be achieved at a work place or training	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			Gouge metal plates **Practical work:** Guide the student on how to perform Gouge metal plates **Activity:** Organize the students in manageable groups to perform Gouge metal plates for different materials thickness	machine, cable and electrode holder Interpret working drawing Set recommended current and arc flow pressure Choose correct electrode for the job Cut work piece with electrode Control electrode travel speed along the Gouge metal plates Clean the oxides along the kerf Clean the equipment, tools and work place Store the equipment and tools in safe place	specifications	**Method used:** The student should explain gouging technique used **Principles:** The student should explain the principles of: • Gouging by arc without pressurized air • Taking measurements **Theories:** The student should explain: • Parts and functions of Gouge metal equipment • Metallurgical effect during gouging **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while Gouge metal plates by arc • Metallurgical	institution. The following tools, equipment and safety gear are to be available: • AC/DC Welding machine • Welding cables • Electrode holder • Gouging torch • Welding shield • Chipping hammer • Wire brush • Work bench • Welding tongs • Angle grinder • Flat file • Bench vice • Scriber • Earth clamp • Ball pein hammer • Centre punch • Tongs • Overalls • Goggles • Leather gloves • Canvas spats • Safety boots Leather apron	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
						effect		
2.Performing gas welding and brazing on ferrous and non-ferrous metals	2.1. Carry out sheet metal welding	(a). Using of gas welding tools and equipment and make fusion welding on sheet metal	**Brainstorm:** Guide the students to define, explain gas welding tools and equipment and procedure of making fusion on sheet metal **Practical work:** Guide the student on how to use gas welding tools and equipment on marking fusion **Activity:** Organize the students in manageable groups to use gas welding tools and equipment for fusion welding different materials	**The student should be able to:** • Inspect gas-welding equipment • Assemble gas plant • Set working pressure • Adjust welding flames • Align and tack weld work pieces • Weld a sheet metal with different flame without filler rode • Maintain movement of blow pipe and molten pad • Maintain angle of torch • Check fusion on metals • Inspect quality of weld ripples • Disassemble	A gas welding tools and equipment Assembled and used according to technical specifications A gas flames setting named and identified	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain uses of gas-welding tools and equipments **Principles:** The student should identify types and uses of: • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipes • Cylinder key • Blow pipe spanner • Spark lighter **Theories:** The student should explain: - Technique and procedure of assembing gas plant - Flame setting and science of welding	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipes • Gas trolley • Cylinder key • Blow pipe spanner • Spark lighter. • Nozzle cleaner • Tongs • Tinted goggles • Ball pein hammer • Chisel • Wire brush • Centre punch • Leather apron • Leather gloves • Safety boots • Canvas spats	**159**

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
				all aparatus • Clean tools and equipment after work • Store tools and equipment safely		flame **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while Assembling tools and equipment - Oxy acetylene flames setting procedures		
		(b).Welding metal in down hand butt joint.	**Brainstorm:** Guide the students to define, explain gas down hand butt joint **Practical work:** Guide the student on how to perform gas down hand butt joint **Activity:** Organize the students in manageable groups to perform gas down hand butt joint for welding	**The student should be able to:** • Inspect gas-welding equipment • Assemble gas cylinder plants accessories • Set working pressure • Light the torch and adjust welding flames • Weld a sheet in down hand butt joint • Maintain movement of blowpipe, angle	A gas welding tools and equipment Assembled and used according to technical specifications A gas flames setting and identified Metal Welded in down hand butt joint	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain gas-welding techniques used **Principles:** The student should explain the principles of: • Minimizing heat input • Obtaining good fusion • Blow pipe maintaining **Theories:** The student should	This element can be achieved at a work place or training institution. The following tools, equipment and safety gear are to be available • Oxy-acetylene plant. And accessories • Tongs • Tinted goggles • Ball pein hammer • Chisel • Wire brush • Centre punch • Leather apron • Leather gloves	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			different materials	of and filler rod • Maintain orderliness of weld ripples • Check root penetration • Inspect quality of weld ripples • Clean tools and equipment after work • Store tools and equipment safely		explain: - Leftward welding - Right ward welding - Weld defects - Metal properties - Different sizes of nozzles - Filler metal used - Flame setting - Back fires and flash back - Metallurgical effects on weldment - Distortion control - Welding symbols **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while Welding metal in down hand butt joint - Oxy acetylene operation procedures	• Safety boots • Canvas spats	
		(c). Welding metal in down hand tee joint.	**Brainstorming**: Guide the students to define	**The student should be able to:** • Inspect gas-welding	A gas welding tools and equipment Assembled and	**Knowledge Evidence** **Detailed knowledge of:**	This element can be achieved at a work place or training institution.	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			and explain a gas down hand tee joint **Think-Ink-Pair-Share**: Guide the students to discuss how to perform a gas down hand tee joint **Interactive Simulation**: Guide the students through performing a gas down hand tee joint for welding different materials **Class Activities**: Organize students into groups to practise welding a gas down hand tee joint	equipment • Assemble gas cylinder plants • Set working pressure • Cut and file a sheet metal • Light the torch and adjust welding flames • Align and tack weld work pieces • Weld a sheet in down hand tee joint • Maintain movement of blowpipe and rod • Maintain angle of torch and filler rod • Maintain orderliness of weld ripples • Check root penetration • Inspect quality of weld ripples • Clean tools and equipment after work	used according to technical specifications A gas flames setting and identified Metal Welded in down hand tee joint	**Method used:** The student should explain gas-welding techniques used **Principles:** The student should explain the principles of: • Minimizing heat input • Obtaining good fusion • Blow pipe maintaining **Theories:** The student should explain: - Leftward welding - Right ward welding - Weld defects - Metal properties - Different sizes of nozzles - Filler metal used - Flame setting - Back fires and flash back - Metallurgical effects on weldment - Distortion control - Welding symbols **Circumstantial**	The following tools, equipment and safety gear are to be available • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipes • Gas trolley • Cylinder key • Blow pipe spanner • Spark lighter • Nozzle cleaner • Tongs • Tinted goggles • Ball pein hammer • Chisel • Wire brush • Centre punch • Leather apron • Leather gloves • Safety boots • Canvas spats	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
				• Store tools and equipment safely		**knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while Welding metal in down hand tee joint Oxy acetylene operation procedures		
		(d). Welding metal in corner joint.	**Brainstorm:** Guide the students to define, explain gas welding down hand corner joint **Practical work:** Guide the student on how to perform gas welding down hand corner joint **Activity:** Organize the students in manageable groups to perform gas welding down hand corner joint for welding	**The student should be able to:** • Inspect gas-welding equipment • Assemble gas cylinder plants • Set working pressure • Cut and file a sheet metal • Light the torch and adjust welding flames • Align and tack weld work pieces • Weld a sheet in down hand corner joint • Maintain	A gas welding tools and equipment Assembled and used according to technical specifications A gas flames setting and identified Metal Welded in down hand corner joint	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain gas-welding techniques used **Principles:** The student should explain the principles of: • Minimizing heat input • Obtaining good fusion • Blow pipe maintaining **Theories:** The student should explain: - Leftward welding	This element can be achieved at a work place or training institution. The following tools, equipment and safety gear are to be available • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipes • Gas trolley • Cylinder key • Blow pipe spanner • Spark lighter • Nozzle cleaner • Tongs • Tinted goggles • Ball pein hammer	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			different materials	movement of blow pipe and rod • Maintain angle of torch and filler rod • Maintain orderliness of weld ripples • Check root penetration • Inspect quality of weld ripples • Clean tools and equipment after work • Store tools and equipment safely		- Right ward welding - Weld defects - Metal properties - Different sizes of nozzles - Filler metal used - Flame setting - Back fires and flash back - Metallurgical effects on weldment - Distortion control - Welding symbols **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while welding metal in down hand corner joint - Oxy acetylene operation procedures	• Chisel • Wire brush • Centre punch • Leather apron • Leather gloves • Safety boots • Canvas spats	
		(e) .Welding metal in horizontal butt joint.	**Brainstorm:** Guide the students to define, explain gas welding metal in	**The student should be able to:** • Inspect gas-welding equipment • Assemble gas	A gas welding tools and equipment Assembled and used according to technical	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should	This element can be achieved at a work place or training institution. The following tools, equipment, and	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			horizontal butt joint **Practical work:** Guide the student on how to perform gas welding metal in horizontal butt joint **Activity:** Organize the students in manageable groups to perform gas welding metal in horizontal butt joint for welding different materials	cylinder plants • Set working pressure • Cut and file a sheet metal • Light the torch and adjust welding flames • Align and tack weld work pieces • Weld a sheet in metal in horizontal butt joint • Maintain movement of blow pipe and rod • Maintain angle of torch and filler rod • Maintain orderliness of weld ripples • Check root penetration • Inspect quality of weld ripples • Clean tools and equipment after work • Store tools and	specifications Identified a gas flames setting Metal Welded in horizontal butt joint	explain gas-welding techniques used **Principles:** The student should explain the principles of: • Minimizing heat input • Obtaining good fusion • Blow pipe maintaining **Theories:** The student should explain: - Leftward welding - Right ward welding - Weld defects - Metal properties - Different sizes of nozzles - Filler metal used - Flame setting - Back fires and flash back - Metallurgical effects on weldment - Distortion control - Welding symbols **Circumstantial knowledge:** **Detailed knowledge**	safety gear are to be available • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipes • Gas trolley • Cylinder key • Blow pipe spanner • Spark lighter • Nozzle cleaner • Tongs • Tinted goggles • Ball pein hammer • Chisel • Wire brush • Centre punch • Leather apron • Leather gloves • Safety boots • Canvas spats	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
				equipment safely		**about:** - Safety precautions to be observed while welding metal in horizontal butt joint - Oxy acetylene operation procedures		
		(f). Welding metal in horizontal tee joint.	**Brainstorm:** Guide the students to define, explain gas welding metal in horizontal tee joint **Practical work:** Guide the student on how to perform gas welding metal in horizontal tee joint **Activity:** Organize the students in manageable groups to perform gas welding metal in horizontal tee joint for welding	**The student should be able to:** • Inspect gas-welding equipment • Assemble gas cylinder plants • Set working pressure • Cut and file a sheet metal • Light the torch and adjust welding flames • Align and tack weld work pieces • Weld a sheet in down hand tee joint • Maintain movement of blow pipe and	A gas welding tools and equipment Assembled and used according to technical specifications Identified a gas flames setting Metal Welded in horizontal corner joint	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain gas-welding techniques used **Principles:** The student should explain the principles of: • Minimizing heat input • Obtaining good fusion • Blow pipe maintaining **Theories:** The student should explain: - Leftward welding - Right ward welding	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipes • Gas trolley. • Cylinder key • Blow pipe spanner • Spark lighter • Nozzle cleaner • Tongs • Tinted goggles • Ball pein hammer • Chisel • Wire brush	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			different materials	rod • Maintain angle of torch and filler rod • Maintain orderliness of weld ripples • Check root penetration • Inspect quality of weld ripples • Clean tools and equipment after work • Store tools and equipment safely		- Weld defects - Metal properties - Different sizes of nozzles - Filler metal used - Flame setting - Back fires and flash back - Metallurgical effects on weldment - Distortion control - Welding symbols **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while welding metal in horizontal corner joint - Oxy acetylene operation procedures	• Centre punch • Leather apron • Leather gloves • Safety boots • Canvas spats	
		(g). Welding metal in horizontal corner joint.	**Brainstorm:** Guide the students to define, explain gas welding metal in horizontal corner joint	**The student should be able to:** • Inspect gas welding equipment • Assemble gas cylinder plants • Set working	A gas welding tools and equipment Assembled and used according to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain gas-welding techniques used	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			Practical work: Guide the student on how to perform gas welding metal in horizontal corner joint **Activity:** Organize the students in manageable groups to perform gas welding metal in horizontal corner joint for welding different materials	pressure • Cut and file a sheet metal • Light the torch and adjust welding flames • Align and tack weld work pieces • Weld a sheet in horizontal corner joint • Maintain movement of blow pipe and rod • Maintain angle of torch and filler rod • Maintain orderliness of weld ripples • Check root penetration • Inspect quality of weld ripples • Clean tools and equipment after work • Store tools and equipment safely	Identified a gas flames setting Metal Welded in horizontal corner joint	**Principles:** The student should explain the principles of: • Minimizing heat input • Obtaining good fusion • Blow pipe maintaining **Theories:** The student should explain: - Leftward welding - Right ward welding - Weld defects - Metal properties - Different sizes of nozzles - Filler metal used - Flame setting - Back fires and flash back - Metallurgical effects on weldment - Distortion control - Welding symbols **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions	• Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipes • Gas trolley • Cylinder key • Blow pipe spanner • Spark lighter • Nozzle cleaner • Tongs • Tinted goggles • Ball pain hammer • Chisel • Wire brush • Centre punch • Leather apron • Leather gloves • Safety boots • Canvas spats	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
						to be observed while welding metal in horizontal corner joint - Oxy acetylene operation procedures		
	2.2. Carrying out metal brazing and bronze welding	(a). Bronzing weld butt joint	**Brainstorming**: Guide the students to define and explain the gas bronzing weld butt joint **Think-Ink-Pair-Share**: Guide the students to discuss how to perform a gas bronzing weld butt joint **Interactive Simulation**: Guide the students through performing the gas bronzing weld butt joint **Class Activities**: Organize students into groups to practise welding a gas bronzing weld	**The student should be able to:** •Inspect gas welding equipment •Assemble gas cylinder •Select nozzle sizes •Select welding rods (bronze rods) •Set working pressure •Cut and file a plate •Light the torch •Adjust welding flames •Align and tack weld work pieces •Braze weld joint •Maintain movement of torch and bronze welding rod •Maintain angle of torch and bronze	A gas welding tools and equipment Assembled and used according to technical specifications welding flames adjusted accordingly Ferrous metal bronze butt welded as per technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain: • Bronzing techniques used • Method of preventing distortion **Principles:** The student should explain the principles of: • Obtaining good fusion on metals • Obtaining root penetration • Blow pipe • Setting gas pressure	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipes • Gas trolley • Cylinder key • Blow pipe spanner • Spark lighter • Nozzle cleaner • Tongs • Tinted goggles • Ball pein hammer • Chisel • Wire brush • Centre punch • Leather apron	**120**

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			butt joint different materials	rod •Ensure non fusion on metals •Maintain orderliness of bronze weld ripples •Check root penetration •Inspect quality of bronze weld •Clean work place •Clean tools and equipment •Store tools and equipment safely		**Theories:** The student should explain: • Metal properties • Bronze weld defects • Metallurgical effect on weldment • Different sizes of welding nozzle and application • Different sizes and types of bronze rods • Different types of flames and their application • Back fire flashback effect and prevention **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precaution to be observed while welding - Metal properties	• Leather gloves • Safety boots • Canvas spats • Industrial boots • Canvas spat • Dust mask	
		(b). Bronzing weld tee joint	**Brainstorm:** Guide students to define, explain Bronzing weld	**The student should be able to:** •Inspect gas-welding equipment	A gas welding tools and equipment Assembled and	**Knowledge Evidence** **Detailed knowledge**	This element can be achieved at a work place or training institution.	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			Practical work: Guide student on how to perform Bronzing weld tee joint **Activity:** Organize the students in manageable group to perform Bronzing weld tee joint different materials	•Assemble gas cylinder •Select nozzle sizes •Select welding rods (bronze rods) •Set working pressure •Cut and file a plate •Light the torch •Adjust welding flames •Align and tack weld work pieces •Braze weld joint •Maintain movement of torch and bronze welding rod •Maintain angle of torch and bronze rod •Ensure non fusion on metals •Maintain orderliness of bronze weld ripples •Check root penetration •Inspect quality of bronze weld •Clean work place	used according to technical specifications welding flames adjusted accordingly Ferrous metal bronze welded as per technical specifications	**of:** **Method used:** The student should explain: • Bronzing techniques used • Method of preventing distortion **Principles:** The student should explain the principles of: • Obtaining good fusion on metals • Obtaining root penetration • Blow pipe • Setting gas pressure **Theories:** The student should explain: • Metal properties • Bronze weld defects • Metallurgical effect on weldment • Different sizes of welding nozzle and application • Different sizes and	The following tools, equipment, and safety gear are to be available • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipes • Gas trolley • Cylinder key • Blow pipe spanner • Spark lighter • Nozzle cleaner • Tongs • Tinted goggles • Ball pain hammer • Chisel • Wire brush • Centre punch • Leather apron • Leather gloves • Safety boots • Canvas spats • Industrial boots • Canvas spat • Dust mask	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
				•Clean tools and equipment •Store tools and equipment safely		types of bronze rods • Different types of flames and their application • Back fire flashback effect and prevention **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precaution to be observed while bronzing weld lap joint - Metal properties		
		(c). Bronzing weld lap joint.	**Brainstorm:** Guide the students to define, explain Bronzing weld **Practical work:** Guide the student on how to perform Bronzing weld lap joint **Activity:** Organize the students in manageable groups to	**The student should be able to:** •Inspect gas-welding equipment •Assemble gas cylinder •Select nozzle sizes •Select welding rods (bronze rods) •Set working pressure •Cut and file a plate •Light the torch •Adjust welding	A gas welding tools and equipment Assembled and used according to technical specifications welding flames adjusted accordingly Ferrous metal bronze welded as per technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain: • Bronzing techniques used • Method of preventing distortion **Principles:** The student should explain the	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipes • Gas trolley • Cylinder key	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			perform Bronzing weld lap joint different materials	flames •Align and tack weld work pieces •Braze weld joint •Maintain movement of torch and bronze welding rod •Maintain angle of torch and bronze rod •Ensure non fusion on metals •Maintain orderliness of bronze weld ripples •Check root penetration •Inspect quality of bronze weld •Clean work place •Clean tools and equipment •Store tools and equipment safely		principles of: • Obtaining good fusion on metals • Obtaining root penetration • Blow pipe • Setting gas pressure **Theories:** The student should explain: • Metal properties • Bronze weld defects • Metallurgical effect on weldment • Different sizes of welding nozzle and application • Different sizes and types of bronze rods • Different types of flames and their application • Back fire flashback effect and prevention **Circumstantial knowledge: Detailed knowledge**	• Blow pipe spanner • Spark lighter • Nozzle cleaner • Tongs • Tinted goggles • Ball pain hammer • Chisel • Wire brush • Centre punch • Leather apron • Leather gloves • Safety boots • Canvas spats • Industrial boots • Canvas spat • Dust mask	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
						about: - Safety precaution to be observed while bronzing weld lap joint - Metal properties		
		(d). Bronze weld corner joint	**Brain storm** Explain the principles of bronze weld corner joint Guide students to explain bronzing techniques **Practical works:** Explain and Demonstrate bronze weld corner joint Guide the students to: Guide the students to bronze weld corner joint **Activity:** Guide the students to Prepare tools and	**The student should be able to:** •Inspect gas-welding equipment •Assemble gas cylinder •Select nozzle sizes •Select welding rods (bronze rods) •Set working pressure •Cut and file a plate •Light the torch •Adjust welding flames •Align and tack weld work pieces •Braze weld joint •Maintain movement of torch and bronze welding rod •Maintain angle of torch and bronze rod •Ensure non fusion	A gas welding tools and equipment Assembled and used according to technical specifications welding flames adjusted accordingly Ferrous metal bronze weld corner joint welded as per technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain: • Bronzing techniques used • Method of preventing distortion **Principles:** The student should explain the principles of: • Obtaining good fusion on metals • Obtaining root penetration • Blow pipe • Setting gas pressure **Theories:** The student should	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipes • Gas trolley • Cylinder key • Blow pipe spanner • Spark lighter • Nozzle cleaner • Tongs • Tinted goggles • Ball pein hammer • Chisel • Wire brush • Centre punch • Leather apron • Leather gloves • Safety boots	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			equipment for bronze weld corner joint Bronze weld corner joint Maintain movement of blowpipe and molten pad	on metals •Maintain orderliness of bronze weld ripples •Check root penetration •Inspect quality of bronze weld •Clean work place •Clean tools and equipment •Store tools and equipment safely		explain: • Metal properties • Bronze weld defects • Metallurgical effect on weldment • Different sizes of welding nozzle and application • Different sizes and types of bronze rods • Different types of flames and their application • Back fire flashback effect and prevention **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precaution to be observed while bronze weld corner joint - Metal properties	• Canvas spats • Industrial boots • Canvas spat • Dust mask	
		(e). Brazing sheet metal seam	**Brain storm** Explain the principles of brazing sheet	**The student should be able to:** •Inspect gas-welding equipment •Assemble gas	A gas welding tools and equipment Assembled and used according	**Knowledge Evidence** **Detailed knowledge** **of:**	This element can be achieved at a work place or training institution. The following tools,	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			metal seam Guide the students to explain branzing techniques **Practical works:** Explain and Demonstrate brazing sheet metal seam Guide the students to brazing sheet metal seam **Activity:** Organize the students in manageable groups to perform Brazing weld sheet metal seam	cylinder •Select nozzle sizes •Select welding rods (bronze rods) •Set working pressure •Cut and file a plate •Light the torch •Adjust welding flames •Align and tack weld work pieces • Brazing sheet metal seam •Maintain movement of torch and bronze welding rod •Maintain angle of torch and bronze rod •Ensure non fusion on metals •Maintain orderliness of bronze weld ripples •Check root penetration •Inspect quality of bronze weld •Clean work place	to technical specifications welding flames adjusted accordingly Ferrous metal Brazing sheet metal seam welded as per technical specifications	**Method used:** The student should explain: • Brazing techniques used • Method of preventing distortion **Principles:** The student should explain the principles of: • Obtaining good fusion on metals • Obtaining root penetration • Blow pipe • Setting gas pressure **Theories:** The student should explain: • Metal properties • Bronze weld defects • Metallurgical effect on weldment • Different sizes of welding nozzle and application • Different sizes and types of bronze	equipment, and safety gear are to be available • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipes • Gas trolley • Cylinder key • Blow pipe spanner • Spark lighter • Nozzle cleaner • Tongs • Tinted goggles • Ball pein hammer • Chisel • Wire brush • Centre punch • Leather apron • Leather gloves • Safety boots • Canvas spats • Industrial boots • Canvas spat • Dust mask	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
				•Clean tools and equipment •Store tools and equipment safely		rods • Different types of flames and their application • Back fire flashback effect and prevention **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precaution to be observed while brazing sheet metal seam - Metal properties		
		(f). Brazing copper/steel pipe	**Brain storm** Explain the principles of brazing copper/steel pipe Guide the students to explain branzing techniques Safety precautions to be observed while brazing copper/steel pipe	**The students should be able to:** •Inspect gas-welding equipment •Assemble gas cylinder •Select nozzle sizes •Select welding rods (bronze rods) •Set working pressure •Cut and file a plate •Light the torch •Adjust welding flames	A gas welding tools and equipment Assembled and used according to technical specifications welding flames adjusted accordingly Ferrous metal Brazing copper/steel pipe welded as per technical	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain: • Brazing techniques used • Method of preventing distortion **Principles:** The student should explain the principles of:	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipes • Gas trolley • Cylinder key • Blow pipe spanner	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			Practical works: Explain and Demonstrate brazing copper/steel pipe Guide the students to: Identfy and Inspect the oxy acetylene tools and equipments Guide the students to brazing copper/steel pipe Guide students to take precaution while brazing copper/steel pipe **Activity:** Guide students to Prepare tools and equipment for brazing copper/steel pipe **B**razing copper/steel pipe Maintain movement of	•Align and tack weld work pieces • Brazing copper/steel pipe •Maintain movement of torch and bronze welding rod •Maintain angle of torch and bronze rod •Ensure non fusion on metals •Maintain orderliness of bronze weld ripples •Check root penetration •Inspect quality of bronze weld •Clean work place •Clean tools and equipment •Store tools and equipment safely	specifications	• Obtaining good fusion on metals • Obtaining root penetration • Blow pipe • Setting gas pressure **Theories:** The student should explain: • Metal properties • Metallurgical effect on weldment • Different sizes of welding nozzle and application • Different sizes and types of bronze rods • Different types of flames and their application • Back fire flashback effect and prevention **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precaution to be observed	• Spark lighter • Nozzle cleaner • Tongs • Tinted goggles • Ball pein hammer • Chisel • Wire brush • Centre punch • Leather apron • Leather gloves • Safety boots • Canvas spats • Industrial boots • Canvas spat • Dust mask	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			blowpipe and molten pad			while brazing copper/steel pipe - Metal properties		
	2.3. Carrying out metal cutting by gas flame	(a). Cut thick and thin metal by gas flames	**Brainstorm:** Guide the students to define, explain gas metal cutting materials **Practical work:** Guide the student on how to Cut thick and thin metal by gas flames **Activity:** Organize the students in manageable groups to cut thick and thin metal by gas flames for different materials	**The students should be able to:** •Inspect gas cutting equipment •Assemble gas cylinder •Select correct nozzle size and type •Set working pressure •Align cutting work piece in position •Light the cutting torch •Adjust cutting flames •Cut work piece •Inspect cut edges (kerf) •Close cutting torch •Close cylinder valve •Inspect quality of cut •Clean work place	A thick and thin metal piece cutting conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain gas cutting procedure **Principles:** The student should explain the principles of: •Cutting metal by gas flame •Obtaining smooth Kerf •Setting cutting flame **Theories:** The student should explain: • Parts of gas cutting equipment and their functions • Recommended working flames	This elemaent can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipes • Gas trolley • Cylinder key • Spark lighter • Ball pein hammer • Chisel • Wire brush • Centre punch • Leather gloves • Clear goggles • Angle grinder • Bench vice • Safety boots • Canvas spats	**80**

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
				•Clean equipment and tools after work •Store tools and equipment safely		and pressure • Side effects of back fire and flash back • Cutting procedures and techniques **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while Cut thick and thin metal by gas flames - Cutting procedures and techniques	• Dust mask • Overalls	
		(b). Cut square and round holes on metals	**Brainstorm:** Guide the students to define, explain gas metal cutting materials **Practical work:** Guide the student on how to Cut square and round holes on metals by gas flames **Activity:** Organize the students in	**The student should be able to:** •Inspect gas-cutting equipment •Assemble gas cylinder •Select correct nozzle size and type •Set working pressure •Align cutting work piece in position •Light the cutting	Square and round holes on metals piece cutting conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain gas-cutting procedure **Principles:** The student should explain the principles of: • Cutting square and	This elemaent can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipes	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			manageable groups to cut square and round holes on metals by gas flames for different materials	torch •Adjust cutting flames •Cut work piece •Inspect cut edges (kerf) •Close cutting torch •Close cylinder valve •Inspect quality of cut •Clean work place •Clean equipment and tools after work •Store tools and equipment safely		round holes on metals by gas flame • Obtaining smooth Kerf • Setting cutting flame **Theories:** The student should explain: • Parts of gas cutting equipment and their functions • Recommended working flames and pressure • Side effects of back fire and flash back • Cutting procedures and techniques **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while cutting square and round holes on metals by gas flames	• Gas trolley • Cylinder key • Spark lighter • Ball pein hammer • Chisel • Wire brush • Centre punch • Leather gloves • Clear goggles • Angle grinder • Bench vice • Safety boots • Canvas spats • Dust mask • Overalls	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
						• Cutting procedures and techniques		
		(c). Making chamfers and remove risers	**Brainstorm:** Guide the students to define, explain gas chamfers and remove risers **Practical work:** Guide the student on how to chamfers and remove risers on metals by gas flames **Activity:** Organize the students in manageable groups to marking chamfers and remove risers on metals by gas flames on different materials	**The student should be able to:** •Inspect gas-cutting equipment •Assemble gas cylinder •Select correct nozzle size and type •Set working pressure •Align cutting work piece in position •Light the cutting torch •Adjust cutting flames •Cut work piece •Inspect cut edges (kerf) •Close cutting torch •Close cylinder valve •Inspect quality of cut •Clean work place	Square and round holes on metals piece cutting conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain gas-cutting procedure **Principles:** The student should explain the principles of: • Making chamfers and remove risers on metals by gas flame • Obtaining smooth Kerf • Setting cutting flame **Theories:** The student should explain: • Parts of gas cutting equipment and their functions	This elemaent can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipes • Gas trolley • Cylinder key • Spark lighter • Ball pein hammer • Chisel • Wire brush • Centre punch • Leather gloves • Clear goggles • Angle grinder • Bench vice • Safety boots • Canvas spats	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	**Service Assessment**	**Knowledge Assessment**		
				•Clean equipment and tools after work •Store tools and equipment safely		• Recommended working flames and pressure • Side effects of back fire and flash back • Cutting procedures and techniques **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while Making chamfers and remove risers by gas flames - Cutting procedures and techniques	• Dust mask • Overalls	
		(d). Gouging metal plate/bar	**Brainstorm:** Guide the students to define, explain gouging metal plate/bar **Practical work:** Guide the student on how to gouging metal	**The student should be able to:** •Inspect gas-cutting equipment •Assemble gas cylinder •Select correct nozzle size and type •Set working	A gouging mild steel plate/bar performed conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain gouging procedure **Principles:**	This elemaent can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Oxy-acetylene plant	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			plate/bar by gas flames **Activity:** Organize the students in manageable groups to gouging metal plate/bar by gas flames	pressure •Align cutting work piece in position •Light the cutting torch •Adjust cutting flames •Cut work piece •Inspect cut edges (kerf) •Close cutting torch •Close cylinder valve •Inspect quality of cut •Clean work place •Clean equipment and tools after work •Store tools and equipment safely		The student should explain the principles of: • Gouging metal plate/bar by gas flame • Obtaining smooth Kerf • Setting gouging flame **Theories:** The student should explain: • Parts of gouging equipment and their functions • Recommended working flames and pressure • Side effects of back fire and flash back • Gouging procedures and techniques **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while gouging metal plate/bar by	• Pressure regulator • Welding torch • Gouging nozzle • Hose pipes • Gas trolley • Cylinder key • Spark lighter • Ball pein hammer • Chisel • Wire brush • Centre punch. • Leather gloves • Clear goggles • Angle grinder • Bench vice • Safety boots • Canvas spats • Dust mask • Overalls	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
						gas flames - Gouging procedures and techniques		
3. Performing arc welding of alloy steels and ferrous metals	3.1. Carrying out welding of alloy steels and ferrous metals	(a). Welding stainless steel by arc welding.	**Brainstorm:** Guide the students to identify relevant tools and equipment using in welding stainless steel by arc welding **Practical work:** Guide the student on how to perform Welding stainless steel by arc **Activity:** Organize the students in manageable groups to perform Welding stainless steel by	**The students should be able to:** • Prepare metal and cut to required sizes and specifications • Grind /File to obtain groove required • Select type of electrode and thickness of electrode • Adjust recommended current • Preheat work piece • Weld stainless steel in all positions • Maintain work angle and lead angle	Welded stainless steel conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used: The students should explain:** •Welding technique used to weld stainless steels •Welding procedures •How to prevent welding defect **Principles: The student should explain:** •How to prevent under bead cracking: •Expansion and contracting forces •How to prevent stresses developed	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Welding machine (AC/DC) • Welding cable • Welding shield • Leather gloves • Leather apron • Chipping hammer • Wire brush • Work bench • Welding tongs • Clear goggles • Angle grinder • Flat file • Bench vice • Overalls • Safety boot	**90**

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			arc	• Maintain suitable arc length • Maintain uniform travel speed along the joint • Control distortion • Avoid weld metal defects • Chip off slag and clean with wire brush • Inspect weld metal defects • Post heat work piece • Equipment and tools cleaned and stored		in the weld •How to control work piece rate of cooling and heat input **Theories**: The students should explain: •Metal properties •Chemical composition of stainless steel •Prevention under bead cracking •Thermal conductivity of metal •Weldability of alloy steels •Preheating and post heating •Electrode classification and coding •Metallurgical effects on weldment •Types of distortion and joint design •Selection of current for welding **Circumstantial knowledge:** **Detailed knowledge**	• Electrode holder • Bench brush	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
						about: •Safety precautions to be observed while stainless steels •First aid •Environmental effects		
		(b). Welding cold cast iron by arc welding.	**Brainstorm:** Guide the students to identify relevant tools and equipment using in welding cold cast iron by arc **Practical work:** Guide the student on how to perform Welding cold cast iron by arc **Activity:** Organize the students in manageable groups to perform cold cast iron by arc	**The students should be able to:** • Prepare metal and cut to required sizes and specifications • Grind /File to obtain groove required • Select type of electrode and thickness of electrode • Adjust recommended current • Weld cast iron in all positions • Maintain work angle and lead angle • Maintain suitable arc length • Maintain	A cold cast iron Welded to conforms technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used: The students should explain:** •Welding technique used to weld cold cast iron •Welding procedures •How to prevent welding defect **Principles: The student should explain:** •How to prevent under bead cracking: •Expansion and contracting forces •How to prevent stresses developed in the weld	This element can be achieved at a work place or training institution. The following tools, equipment and safety gear are to be available • Welding machine (AC/DC) • Welding cable • Welding shield • Leather gloves • Leather apron • Chipping hammer • Wire brush • Work bench • Welding tongs • Clear goggles • Angle grinder • Flat file • Bench vice • Overalls • Safety boot • Electrode holder	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
				uniform travel speed along the joint • Control distortion • Avoid weld metal defects • Chip off slag and clean with wire brush • Inspect weld metal defects • Equipment and tools cleaned and stored		•How to control work piece rate of cooling and heat input **Theories**: The students should explain: •Metal properties •Chemical composition of cast iron •Prevention under bead cracking •Thermal conductivity of metal •Weldability of cast iron metal •Electrode classification and coding •Types of distortion and joint design •Selection of current for welding **Circumstantial knowledge:** **Detailed knowledge about:** • •Safety precautions to be observed while weld cold cast iron	• Bench brush	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
						• •First aid • •Environmental effects		
	3.2. Carrying out welding of stainless and carbon steel by TIG welding	(a). Welding stainless Steel pipe by TIG.	**Brain storm** Guide the students to: Define TIG Explain TIG welding techniques used and Safety precautions to be observed while welding stainless steel pipes Explain principles of TIG welding, and Purging Identify different types of tungsten electrodes **Practical work:** Guide the student on how to perform Welding	**The student should be able to:** •Inspect TIG welding equipment and accessories •Select shielding gases •Select welding polarity •Prepare tungsten electrodes •Regulate gas flow rate •Select correct torch nozzle •Adjust recommended current •Select correct filler metal •Prepare metal for welding •Align and tack weld •Initiate the arc and weld the	Welded stainless pipe work piece conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain • Metals and composition of stainless steels • TIG welding techniques used to weld stainless pipe **Principles:** The student should explain the principles of: • TIG welding • Purging **Theories:** The student should explain: • Basic principles of TIG welding • How to identify metals and	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Automatic TIG welding machine • TIG welding machine • Argon cylinder • Gas Flow meter • Welding cables • Welding gun/torch • Work bench • Welding helmet • Tong • Bench vice • Angle grinder • Welding shield • Leather gloves. • Leather apron	**90**

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			stainless Steel pipe by TIG **Activity:** Organize the students in manageable groups to perform stainless Steel pipe by TIG	stainless steel pipe •Maintain work and lead angle •Maintain uniform travel speed along the joint •Control distortion •Avoid weld metal defects •Clean weldment with acid •Inspect weld metal defects •Clean work place •Clean tools and equipment and store them safely		composition of steel • Different types of tungsten electrodes • Different types of TIG filler wires and nozzles • The importance of high frequency starting unit • Different TIG welding techniques • The use of cleaning acid • Different type of TIG welding machine **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while performing stainless pipe TIG welding • Operational procedures for stainless pipe TIG welding	• Overalls • Canvas spats	
		(b). Welding carbon Steel pipe by TIG.	**Brain storm** Guide the students to: Define TIG	**The student should be able to:** •Inspect TIG welding equipment and accessories •Select shielding	Welded carbon steel pipe work piece conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should	This element can be achieved at a work place or training institution. The following tools, equipment, and	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			Explain TIG welding, techniques used and Explain principles of TIG welding, and Purging **Practical works:** Explain and Demonstrate carbon steel pipe welding procedures Guide the students to: Prepare carbon steel pipe and cut to required sizes and specifications Weld carbon steel pipe in flat/horizontal rolled position **Activity:** Organize the students to Prepare carbon steel pipe and	gases •Select welding polarity •Prepare tungsten electrodes •Regulate gas flow rate •Select correct torch nozzle •Adjust recommended current •Select correct filler metal •Prepare carbon steel pipe for welding •Align and tack weld •Initiate the arc and weld the carbon steel pipe •Maintain work and lead angle •Maintain uniform travel speed along the joint •Control distortion •Avoid weld metal defects •Clean weldment with acid •Inspect weld metal defects		explain • Metals and composition of carbon steels • TIG welding techniques used to weld carbon steel pipe **Principles:** The student should explain the principles of: • TIG welding • Purging **Theories:** The student should explain: • Basic principles of TIG welding • How to identify metals and composition of carbon steel • Different types of tungsten electrodes • Different types of TIG filler wires and nozzles • The importance of high frequency starting unit • Different TIG welding techniques • Different type of	safety gear are to be available • Automatic TIG welding machine • TIG welding machine • Argon cylinder • Gas Flow meter • Welding cables • Welding gun/torch • Work bench • Welding helmet • Tong • Bench vice • Angle grinder • Welding shield • Leather gloves • Leather apron • Overalls Canvas spats	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			Performing butt welding joint of carbon steel pipe in flat/horizontal rolled position using TIG	•Clean work place •Clean tools and equipment and store them safely		TIG welding machine **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while performing carbon steel pipe TIG welding • Operational procedures for carbon steel pipe TIG welding		
	3.3. Carrying out welding of stainless and carbon steel pipes by MIG/MAG.	(a). Welding stainless steel by MIG and MAG welding	**Brain storm** Guide the students to: Define MIG/MAG Explain MIG/MAG welding, techniques used and Safety precautions to be observed while welding stainless steel Explain the principles of MIG/MAG	**The student should be able to:** • Inspect MIG/MAG welding equipment • Select inert gases/active gases • Select welding polarity • Select MIG/MAG welding wire • Regulate gas flow rate • Adjust recommended current • Prepare stainless steel metal for	Welded stainless steel conform to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain welding techniques used to weld stainless steel by MIG/MAG **Principles:** The student should explain the principles of: • MIG/MAG welding • MIG/MAG set up **Theories:** The student should	This element can be achieved at a work place or training institution. The followings tools equipment and safety gear are to be available • MIG/MAG welding machine • Argon cylinder • Carbon dioxide cylinder • Pressure regulator • Welding cables • Welding gun/torch • Work bench	**90**

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			welding, Identify different types of MIG/MAG nozzles **Practical works:** Explain and Demonstrate stainless steel MIG/MAG welding procedures Guide the students to: Prepare stainless steel and cut to required sizes and specifications Grind /File to obtain surface required Weld butt welding joint of stainless steel **Activity:** Organize the	welding • File grooves on work piece • Apply ant-spatter to a nozzle • Align work piece and tack weld • Initiate the arc and weld metal • Maintain work and lead angle • Maintain suitable arc length • Maintain uniform travel speed along joint • Control distortion • Avoid weld metal defects • Inspect weld metal defects • Clean work place • Clean tools and equipment and store them safely		explain: • Basic principles of MIG/MAG welding • How to identify metals and composition of steel • Different types of consumable wires • Different types of shielding gases • Different types of MIG/MAG torches/guns • MIG/MAG welding techniques • The use of ant-spatter • Types of materials for MIG/MAG welding **Circumstantial Knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while performing stainless steel MIG/MAG welding • Set up principles of MIG/MAG	• Welding helmet • Tong • Chipping hammer • Bench vice • Angle grinder • Welding shield • Leather gloves • Leather apron • Clear goggles • Safety boots • Overalls.	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			students to Prepare stainless steel plate and Performing butt welding joint of stainless steel					
		(b). Welding carbon steel by FCAW	**Brain storm** Guide the students to: Define FCAW Explain FCAW welding, techniques used and Safety precautions to be observed while welding carbon steel Explain principles of FCAW welding, **Practical works:** Explain and Demonstrate carbon steel FCAW welding procedures Guide the students to: Prepare carbon steel and cut to	**The student should be able to:** • Inspect FCAW welding equipment • Select inert gases/active gases • Select welding polarity • Select FCAW welding wire • Regulate gas flow rate • Adjust recommended current • Prepare stainless steel metal for welding • File grooves on work piece • Apply ant-spatter to a nozzle • Align work piece and tack weld • Initiate the arc and weld metal • Maintain work and lead angle	Welded carbon steel conform to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain welding techniques used to weld stainless steel by FCAW **Principles:** The student should explain the principles of: • FCAW welding • FCAW set up **Theories:** The student should explain: • Basic principles of FCAW welding • How to identify metals and composition of steel • Different types of consumable wires • Different types of shielding gases	This element can be achieved at a work place or training institution. The followings tools, equipment, and safety gear are to be available • FCAW welding machine • Argon cylinder • Carbon dioxide cylinder • Pressure regulator • Welding cables • Welding gun/torch • Work bench • Welding helmet • Tong • Chipping hammer • Bench vice • Angle grinder • Welding shield • Leather gloves • Leather apron • Clear goggles	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			required sizes and specifications Weld butt welding joint of carbon steel **Activity:** Organize the students to Prepare carbon steel plate and Performing butt welding joint of carbon steel	• Maintain suitable arc length • Maintain uniform travel speed along joint • Control distortion • Avoid weld metal defects • Inspect weld metal defects • Clean work place • Clean tools and equipment and store them safely		• Different types of FCAW torches/guns FCAW welding techniques • The use of ant-spatter • Types of materials for FCAW welding **Circumstantial Knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while performing carbon steel FCAW welding • Set up principles of FCAW	• Safety boots • Overalls.	
	3.4. Filling worn-out metal surfaces	(a). Deposit metal by arc welding / Pad welding	**Brain storm** Guide the students to: Define Pad welding Explain Pad welding techniques used and Safety precautions to be observed while Pad welding Explain	**The student should be able to:** • Inspect welding machine, cables and electrode holder • Select hard ware resistance electrodes • Select type of metal to be Pad welding • Use appropriate electrodes for different types of	The deposited metal surface conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain: • The pad welding techniques used • The techniques for controlling distortion **Principles:** The student should explain the	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • AC/DC Welding machine • Welding cable • Welding shield • Leather gloves • Leather apron	**90**

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			principles of Pad welding **Practical works:** Explain and Demonstrate Pad welding procedures Guide the students to: Prepare metal and cut to required sizes and specifications Set recommended current Deposit metal by arc welding **Activity:** Organize the students to Prepare metal plate and Rebuilding a worn shaft by welding straight bead	Pad welding practice • Select recommended current for Pad welding • Pad welding to a required specification • Clean work piece • Clean tools and equipment and store them safely		principles of: • Pad welding - Selecting surfacing process **Theories:** The student should explain: - Properties of materials - Pad welding electrode specification - Determination of hardness in Pad welding materials - Different weaving techniques - Metallurgical effect of heat on metals - Selection of polarities **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while performing Pad welding - Operation techniques for controlling distortion	• Chipping hammer • Wire brush • Welding helmet • Tong • Work bench • Welding tongs • Clear goggles • Angle grinder • Flat file • Bench vice • Overalls • Safety boots • Canvas spats • Electrode holder Earth clamp	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
		(b). Hard face surfaces welding.	**Brain storm** Guide the students to: Define Hard face surfaces welding Explain Hard face surfaces welding techniques used and Safety precautions to be observed while hard face surfaces welding Explain principles of hard face Explain heat treatment post and pre heat **Practical works:** Explain and Demonstrate hard face surfaces welding procedures Guide the students to:	**The student should be able to:** • Inspect welding machine, cables and electrode holder • Select hard ware resistance electrodes • Select type of metal to be hard surfaced • Heat-treats metals • Use appropriate electrodes for different types of wear • Identify worn out parts • Select recommended current for hard face surfaces welding • Pre heat and post heat weldment • Weld to a required specification • Clean work piece	The hard face surfaces metal welding conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain: • The hard face surfaces welding techniques used • The techniques for controlling distortion • Principles: The student should explain the principles of: • Hard face surfaces welding • Selecting surfacing process **Theories:** The student should explain: • Properties of materials • Hard face surfaces welding electrode specification • Determination of hardness in hard face surfaces welding materials	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • AC/DC Welding machine • Welding cable • Welding shield • Leather gloves • Leather apron • Chipping hammer • Wire brush • Welding helmet • Tong • Work bench • Welding tongs • Clear goggles • Angle grinder • Flat file • Bench vice • Overalls • Safety boots • Canvas spats • Electrode holder Earth clamp	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			Prepare metal and cut to required sizes and specifications Hard face surfaces by arc welding **Activity:** Organize the students to Prepare metal plate and hard face surfaces welding	• Clean tools and equipment and store them safely		• Different weaving techniques • Metallurgical effect of heat on metals - Selection of polarities **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while performing hard face surfaces welding - Operation techniques for controlling distortion		
	3.5. Cutting steel plates using plasma-arc	(a) Cutting steel plate using plasma arc cutting machine	**Brain storm** Guide the students to: Define plasma arc cutting Explain plasma arc cutting techniques used and Safety precautions to be observed while plasma arc	**The student should be able to:** • Inspect plasma-welding equipment • Select recommended type and size of nozzle • Prepare materials for cutting • Adjust flow rate of water and compressed air • Set recommended current	A cut steel plate conforms to technical standards	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the plasma techniques used and how to operate plasma-cutting equipment **Principles:** The student should	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Plasma cutting machine • Plasma cutting gun/torch • Cutting table	**90**

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			cutting Explain Air Cutting Pressure setup Identify types of torches used for plasma arc cutting **Practical works:** Explain and Demonstrate steel plate plasma cutting procedures Guide the students to: Mark the measurement to be cut Prepare metal and cut to required sizes and specifications Cut steel plate using plasma arc cutting machine **Activity:**	• Cut work piece • Maintain torch angle and travel speed • Inspect quality of cut • Clean workplace, machine and tools • Store tools and equipment safely		explain**:** • The student should explain the principle involved in cutting of steel plates using plasma arc cutting **Theories:** The student should explain: • Main parts of plasma arc cutting equipment • Structure and application of various parts • Air Cutting Pressure setup • Types of plasma arc cutting • Types of torches used for plasma arc cutting • Identification of metals and composition of steel **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed when performing plasma	• Air compressor / Gas cylinder • Pressure regulator/service unit • Cables/pipes • Welding helmet • Chipping hammer • Welding tongs • Leather gloves • Overalls • Safety boots • Canvas spats • Leather Apron	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			Organize the students to Prepare metal plate and Cutting a piece of mild steel plate from a bulk mild steel plate using plasma arc cutting machine			cutting • Operation procedures for plasma cutting machine		
		(b) Cutting steel pipes using plasma arc cutting	**Brain storm** Guide the students to: Define plasma arc cutting Explain plasma arc cutting techniques used and Safety precautions to be observed while plasma arc cutting Explain principles of plasma arc cutting **Practical works:** Explain and Demonstrate	**The student should be able to:** • Inspect plasma-welding equipment • Select recommended type and size of nozzle • Prepare mild steel pipe for cutting • Adjust flow rate of water and compressed air • Set recommended current • Cut mild steel pipe piece • Maintain torch angle and travel speed • Inspect quality of cut • Clean workplace,	A cut mild steel pipe conforms to technical standards	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the plasma techniques used and how to cut mild steel pipe by plasma cutting equipment **Principles:** The student should explain**:** • The student should explain the principle involved in cutting of mild steel pipe using plasma arc cutting **Theories:**	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Plasma cutting machine • Plasma cutting gun/torch • Cutting table • Air compressor / Gas cylinder • Pressure regulator/service unit • Cables/pipes • Welding helmet • Chipping hammer • Welding tongs • Leather gloves	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			mild steel pipe plasma cutting procedures Guide the students to: Prepare mild steel pipe and cut to required sizes and specifications Cutting mild steel pipe using plasma arc cutting machine **Activity:** Organize the students to Prepare mild steel pipe and cutting a mild steel pipe as per drawing specification using plasma arc cutting machine	machine and tools • Store tools and equipment safely		The student should explain: • Main parts of plasma arc cutting equipment • Structure and application of various parts • Air Cutting Pressure setup • Types of plasma arc cutting • Types of torches used for plasma arc cutting • Identification of metals and composition of steel **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed when performing mild steel pipe plasma cutting • Operation procedures for mild steel pipe plasma cutting machine	• Overalls • Safety boots • Canvas spats • Leather Apron	
	3.6. Cutting steel plates using an	(a).Cutting mild steel plates using	**Brain storm**	**The student should be able to:**	A cut mild steel plate conforms	**Knowledge Evidence**	This element can be achieved at a work	**90**

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
	electric arc cutting machine	air carbon arc cutting machine (gouging)	Guide the students to: Define electric arc cutting Explain electric arc cutting techniques used and Safety precautions to be observed while electric air carbon arc cutting Explain principles of electric air carbon arc cutting **Practical works:** Explain and Demonstrate steel plate air carbon arc cutting procedures Guide the students to: Mark the measurement to be cut	• Select appropriate machine for the work piece • Select correct electrode size • Select appropriate gas • Set correct polarity for electrode/work piece • Select correct electrode holder • Select recommended current • Select correct gas flow rate • Cut work piece • Maintain cutting speed and angle of electrode • Inspect quality of cut • Clean work place • Store tool and equipment	to technical standards	**Detailed knowledge of:** **Method used:** The student should explain the arc cutting techniques used and how to operate different arc cutting equipment **Principles:** The student should explain the principles of: • Different arc cutting process • How to operate different arc cutting equipment **Theories:** The student should explain: • Difference between DC – AC current • Type of gas used for removal of molten material • Principles of removal of molten material • Machine parts of arc cutting	place or training institution. The following tools, equipment, and safety gear are to be available • Arc cutting machine • Arc cutting electrode holder • Oxygen cylinder • Compressed air • Gas regulator • Face shield • Cutting table • Tongs • Chipping hammer • • Chisel and hammer • Leather gloves • Safety boots • Leather apron	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			Prepare metal and cut to required sizes and specifications Cut steel plate using air carbon arc cutting machine **Activity:** Organize the students to Prepare metal plate and Performing air arc gouging on a mild steel plate			equipment • Types of arc cutting methods **Circumstantial Knowledge:** **Detailed knowledge about:** • Safety precautions to be observed when performing arc cutting • Operation procedures for arc cutting machine		
		(b). Cutting mild steel plates using oxygen arc cutting machine (lancing)	**Brain storm** Guide the students to: Define electric arc cutting Explain electric arc cutting techniques used and Safety precautions to be observed while electric air oxygen arc cutting	**The student should be able to:** • Select appropriate machine for the work piece • Select correct electrode size • Select appropriate gas • Set correct polarity for electrode/work piece • Select correct	A cut mild steel plate conforms to technical standards	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the arc cutting techniques used and how to operate different arc cutting equipment **Principles:** The student should explain the principles of:	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Arc cutting machine • Arc cutting electrode holder • Oxygen cylinder • Compressed air • Gas regulator	

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per unit
				Process Assessment	Service Assessment	Knowledge Assessment		
			Practical works: Explain and Demonstrate steel plate air oxygen arc cutting procedures Guide the students to: Mark the measurement to be cut Prepare metal and cut to required sizes and specifications Cut steel plate using air oxygen arc cutting machine **Activity:** Organize the students to Prepare metal plate and Performing lancing on a mild steel shaft	electrode holder • Select recommended current • Select correct gas flow rate • Cut work piece • Maintain cutting speed and angle of electrode • Inspect quality of cut • Clean work place • Store tool and equipment		• Different arc cutting process • How to operate different arc cutting equipment **Theories:** The student should explain: • Difference between DC – AC current • Type of gas used for removal of molten material • Principles of removal of molten material • Machine parts of arc cutting equipment • Types of arc cutting methods **Circumstantial Knowledge:** **Detailed knowledge about:** • Safety precautions to be observed when performing oxygen air arc cutting • Operation procedures for oxygen air arc cutting machine	• Face shield • Cutting table • Tongs • Chipping hammer • • Chisel and hammer • Leather gloves • Safety boots • Leather apron	

Form Three

Table 5: *Detailed Contents for Form Three*

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Unit	Number of Periods per unit
				Process Assessment	Services Assessment	Knowledge Assessment		
1.0 Performing Gas Welding on Ferrous and Non-Ferrous Metals	1.1 Carrying out welding of ferrous metals	(a) Welding Mild Steel in Vertical Butt (3G)	**Demonstration:** The instructor demonstrates welding mild steel in the vertical butt position, showing the correct gas flame settings and the proper movement of the torch and filler rod **Practical Work:** The students practice welding mild steel in the vertical butt (3G) position, adjusting their techniques and ensuring proper torch control and heat distribution	The student should be able to: - Set up the oxy-acetylene equipment correctly for vertical butt welding - Maintain proper torch angle and travel speed during the weld	The weld should have consistent ripples, good fusion, proper root penetration, and no excessive spatter The final weld must conform to technical specifications	**Knowledge Evidence:** Detailed knowledge of: - Gas welding techniques for vertical butt (3G) positions - Effects of torch angle and travel speed on weld quality **Principles:** The students should explain: • Operation process of welding plant. • Welding metal process by gas flame. - Setting and operation of welding torches. - Setting recommended flame and pressure. **Theories:** The students should explain: - Main parts of gas welding equipment and their functions. - The effects of backfire and flashback. - The equipment for welding metals by gas flame. - Functions of low and high pressure gas generating. **Circumstantial**	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Oxy-acetylene plant - Pressure regulator - Welding torch - Hose pipe - Gas cylinder - Trolley for gas cylinders - Spark lighter - Welding tongs. - Ball pein hammer. - Work bench. - Chisel. - Wire brush - Leather apron.	180

						knowledge: **Detailed knowledge about:** - Safety precautions to be observed when performing gas welding. Welding methods applicable for different type/sizes of materials.	- Clear goggles. - Tinted goggle - Leather gloves. - Industrial boots. - Canvas spats. - Overalls.	
		(b) Welding Mild Steel in Overhead Position (4G)	**Practical Work:** The instructor demonstrates welding mild steel in the overhead (4G) position, emphasizing torch control, speed, and heat application The students practise welding in the overhead position with guidance on maintaining a steady arc and filling the joint	The student should be able to: - Set up and operate the oxy-acetylene equipment correctly for overhead welding - Maintain proper torch angle and travel speed while welding in the overhead position	The weld should be clean, with smooth ripples and good penetration, and no defects such as undercut or slag inclusions	**Knowledge Evidence:** Detailed knowledge of: Methods - Gas welding techniques for overhead (4G) welding - Adjusting the gas flame and maintaining the proper angle in difficult positions **Principles:** The students should explain: • Operation process of welding plant. • Welding metal process by gas flame. - Setting and operation of welding torches. - Setting recommended flame and pressure. **Theories:** The students should explain: - Main parts of gas welding equipment and their functions. - The effects of backfire and flashback. - The equipment for welding metals by gas flame. - Functions of low and high pressure gas generating. **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed when performing gas welding. Welding methods applicable for different type/sizes of materials.	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Oxy-acetylene plant - Pressure regulator - Welding torch - Hose pipe - Gas cylinder - Trolley for gas cylinders - Spark lighter - Welding tongs. - Ball pein hammer. - Work bench. - Chisel. - Wire brush - Leather apron. - Clear goggles. - Tinted goggle - Leather gloves. - Industrial boots. - Overalls.	

	1.2 Carrying Out Welding of Non-Ferrous Metals	(a) Welding Aluminum by gas welding	**Demonstration:** The instructor demonstrates how to weld aluminum using oxy-acetylene equipment, focusing on controlling heat and selecting the proper filler rods **Practical Work:** The students practise welding aluminum, ensuring they adjust the flame to prevent overheating and follow correct torch and rod movement	The student should be able to: - Inspect the oxy-acetylene equipment for proper function before starting - Select and assemble the correct equipment and materials for aluminum welding	The weld should have uniform heat application with no burning or overheating of the aluminum Proper fusion and root penetration should be achieved without excessive oxidation	**Knowledge Evidence:** Detailed knowledge of: - Gas welding techniques for aluminum - How to control heat to prevent warping or burning **Principles:** The student should explain: - Operating process of gas welding plant. - Welding metal by gas flame. - Operation of welding torches. - Setting of recommended flame and pressure. **Theories:** The student should explain: - Main parts of gas welding equipment and their function. - The effects of backfire and flashback. - Function of low and high pressure gas generating systems. **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while performing gas welding. Observing the melting point of aluminum alloy.	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Oxy-acetylene plant - Pressure regulator - Welding torch - Hose pipe - Gas cylinder - Trolley for gas cylinders - Spark lighter - Welding tongs. - Ball pein hammer. - Work bench. - Chisel. - Wire brush - Leather apron. - Clear goggles. - Tinted goggle - Leather gloves. - Industrial boots. - Canvas spats. - Overalls.	160

		(b) Welding copper alloys by gas welding	**Practical Work:** The instructor demonstrates welding of copper alloys, showing the correct flame settings and techniques to prevent overheating and oxidation of copper **Practical Work:** The students practise welding copper alloys, maintaining proper flame settings and movement for optimal fusion and finish	The student should be able to - Set up the equipment correctly for copper alloy welding - Maintain proper flame settings and welding technique to avoid overheating or oxidation	The weld should have good fusion and a smooth finish, with no signs of overheating, oxidation, or warping Proper joint alignment and root penetration are required	**Knowledge Evidence:** Detailed knowledge of: - Gas welding techniques specific to copper alloys - Handling and controlling the welding process to avoid oxidation or burning of copper **Principles:** The student should explain: - Operating process of gas welding plant. - Welding metal by gas flame. - Operation of welding torches. - Setting of recommended flame and pressure. **Theories:** The student should explain: - Main parts of gas welding equipment and their function. - The effects of backfire and flashback. - Function of low and high pressure gas generating systems. **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while performing gas welding. Observing the melting point of copper alloys.	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Oxy-acetylene plant - Pressure regulator - Welding torch - Hose pipe - Gas cylinder - Trolley for gas cylinders - Spark lighter - Welding tongs. - Ball pein hammer. - Work bench. - Chisel. - Wire brush - Leather apron. - Clear goggles. - Tinted goggle - Leather gloves. - Industrial boots. - Canvas spats. - Overalls.	

	1.3 Carrying Out Oxy-Fuel Powder Cutting	(a) Cutting Cast Iron by Powder Cutting Process	**Demonstration:** The instructor demonstrates the oxy-fuel powder cutting process, focusing on setup, flame adjustment, and cutting technique for cast iron **Practical Work:** The students practice setting up the equipment, adjusting the flame, and cutting cast iron while ensuring proper alignment of the torch and work piece	The student should be able to: - Inspect and set up oxy-fuel cutting equipment correctly for cast iron cutting - Adjust the flame and set the recommended pressure	The cut cast iron should meet the technical specifications, showing clean edges and no excessive heat-affected zones	**Knowledge Evidence:** Detailed knowledge of: - Techniques for cutting cast iron using oxy-fuel powder cutting - Effects of flame settings and gas pressure on the quality of the cut **Principles:** The student should explain: • Operation process of powder cutting equipment. • Method of aligning torch during cutting. • Setting gas pressure. **Theories:** Thestudent should explain: - Tools and equipment used. - Metal properties. - Metallurgical effect on cut edges. - Installation of powder cutting equipment. - Feeding powder in feeder unit. - Selection of different sizes of nozzles. - Operation of the lance/torch. - Methods of cutting non-ferrous metals. **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while performing cutting. Operating principle of powder cutting equipment	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Oxy-acetylene cylinders - Pressure regulator - Hose pipe - Tongs - Chemical flux feeder unit (dispenser). - Pressure regulator. - Hose pipe. - Compressor. - Tinted goggles - Leather gloves - Workbench	120

		(b) Cutting Aluminum by Powder Cutting Process	**Practical Work:** The instructor demonstrates the cutting of aluminum using oxy-fuel powder cutting equipment, highlighting flame control, nozzle selection, and effective cutting techniques for non-ferrous metals **Practical Work:** The students practice cutting aluminum and focus on controlling the flame to avoid oxidation and ensuring smooth, clean cuts	The student should be able to: - Select and assemble the correct equipment and materials for aluminum cutting - Adjust the flame and pressure for optimal cutting	The cut aluminum should be clean, free of oxidation, and show good fusion, with minimal burrs or rough edges	**Knowledge Evidence:** Detailed knowledge of: - Cutting techniques for aluminum using oxy-fuel powder cutting - Managing flame settings to prevent oxidation **Principles:** The student should explain: • Operation process of powder cutting equipment. • Method of aligning torch during cutting. • Setting gas pressure. **Theories:** The student should explain: - Tools and equipment used. - Metal properties. - Metallurgical effect on cut edges. - Installation of powder cutting equipment. - Feeding powder in feeder unit. - Selection of different sizes of nozzles. - Operation of the lance/torch. - Methods of cutting non-ferrous metals. **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while performing cutting. Operating principle of powder cutting equipment	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Chemical flux feeder unit (dispenser). - Pressure regulator. - Hose pipe. - Compressor. - Tongs - Scriber - Clear goggles - Leather apron - Hammer - Safety boots

		(c) Cutting copper by powder cutting process	**Practical Work:** The instructor demonstrates cutting copper using the oxy-fuel powder cutting technique, showing how to control the flame and select the correct nozzles for cutting copper alloys **Practical Work:** The students practise cutting copper while focusing on correct torch angle, movement, and flame settings	The student should be able to: - Set up the oxy-fuel cutting equipment for copper cutting - Maintain proper flame and pressure settings to avoid oxidation and ensure a clean cut	The cut copper should have smooth, uniform edges, with good fusion and no signs of oxidation or overheating	**Knowledge Evidence:** Detailed knowledge of: - Techniques for cutting copper using oxy-fuel powder cutting - Importance of proper flame control and nozzle selection **Principles:** The student should explain: • Operation process of powder cutting equipment. • Method of aligning torch during cutting. • Setting gas pressure. **Theories:** The student should explain: - Tools and equipment used. - Metal properties. - Metallurgical effect on cut edges. - Installation of powder cutting equipment. - Feeding powder in feeder unit. - Selection of different sizes of nozzles. - Operation of the lance/torch. - Methods of cutting non-ferrous metals. **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while performing cutting. Operating principle of powder cutting equipment	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Oxy-acetylene cylinders - Hammer - Straight edge - Centre punch - Leather gloves - Safety boots - Chemical flux feeder unit (dispenser). - Pressure regulator. - Hose pipe. - Compressor. - Tong	

	1.4 Carrying Out Oxy-Fuel Gas Cutting	(a) Cutting steel plate by gas using profile cutting machine	**Demonstration:** The instructor demonstrates oxy-fuel gas cutting on steel plates using a profile-cutting machine, including interpretation of the drawing, setup, and cutting process **Practical Work:** The students practise setting up the equipment, selecting the correct nozzle, and cutting according to the drawing specifications	The student should be able to - Interpret working drawings to determine cutting paths - Set up the oxy-fuel cutting machine and select the appropriate nozzle size - Perform the cutting process with correct traversing speed and pressure settings	The cut steel plate should conform to the profile specifications in the working drawing, with clean edges and minimal slag	**Knowledge Evidence:** Detailed knowledge of: - Profile gas-cutting techniques - Correct operation of profile cutting equipment - Selection of the correct nozzle size for different cutting tasks **Principles:** The student should explain the principles of: • Operation process for profile cutting equipment. • Influence of cutting speed to the quality of edge cut. **Theories:** The student should explain: - Parts of profile cutting machine - Material properties of different steels. **Circumstantial Knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while performing cutting using a profile cutting machine. Operation principle for profile cutting equipment	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Profile cutting machine - Oxy-acetylene plant - Gas welding goggle - Tongs - Leather apron - Nozzle cleaner - Safety boots	119

		(b) Cut steel flange by radius cutter	**Practical Work:** The instructor demonstrates the cutting of steel flanges using a radius cutter, explaining the setup of the cutter, the nozzle selection, and the adjustment of traversing speed **Practical Work:** The students practise cutting flanges, focusing on maintaining the correct radius and adjusting the cutter's guide rail	The student should be able to - Set up the radius cutter with the correct guide rails - Adjust the cutter's speed for an efficient and clean cut - Inspect the flange after cutting to ensure conformity to the required radius	The cut steel flange should have smooth edges and meet the radius specifications in the working drawing	**Knowledge Evidence:** Detailed knowledge of: - The operation and setup of a radius cutter - Effects of cutting speed on the quality of the flange cut **Principles:** The student should explain the principles of: • Operation process for profile cutting equipment. • Influence of cutting speed to the quality of edge cut. **Theories:** The student should explain: - Parts of profile cutting machine - Material properties of different steels. **Circumstantial Knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while performing cutting using a profile cutting machine. Operation principle for profile cutting equipment	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Radius cutter - Profile cutting machine - Soap stone chalk - Centre punch - Leather gloves - Scribers

		(c) Cut steel pipes	**Practical Work:** The instructor demonstrates the oxy-fuel gas cutting of steel pipes, focusing on cutting speed, nozzle size selection, and the importance of accurate torch movement **Practical Work:** The students practise cutting steel pipes, ensuring they maintain the correct angle and cutting speed to achieve smooth cuts	The student should be able to - Set up the oxy-fuel cutting equipment for pipe cutting - Select the appropriate nozzle size for steel pipe cutting - Adjust the torch angle and cutting speed to ensure the cut is smooth and precise	The cut steel pipe should meet the required specifications with clean edges and uniform thickness along the cut	**Knowledge Evidence:** Detailed knowledge of: - Cutting steel pipes using oxy-fuel gas cutting - Importance of cutting angle and speed for achieving a clean cut on pipes **Principles:** The student should explain the principles of: • Operation process for profile cutting equipment. • Influence of cutting speed to the quality of edge cut. **Theories:** The student should explain: - Parts of profile cutting machine - Material properties of different steels. **Circumstantial Knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while performing cutting using a profile cutting machine. Operation principle for profile cutting equipment	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Oxy-acetylene plant - Radius cutter - Nozzle cleaner - Gas welding goggle - Leather apron - Safety boots	

2.0 Performing Fabrication Works According to the Specification	2.1 Performing Sheet Metal Fabrication	(a) Fabricating Equal Centre Cone from Sheet Metal	**Demonstration:** The instructor demonstrates the process of fabricating an equal center cone from sheet metal, including interpreting working drawings, selecting material, and cutting the pattern **Practical Work:** The students practise measuring, marking, and cutting metal according to technical specifications	The student should be able to: - Interpret working drawings accurately - Measure and calculate allowances - Cut and form the metal sheet according to the drawing specifications	The fabricated cone should conform to the technical specifications in the working drawing, with proper dimensions and smooth edges	**Knowledge Evidence:** Detailed knowledge of: - Methods to develop cylindrical and offset cones - Principles of sheet metal pattern development - Forming allowances and material properties **Principles:** The student should explain the principles of: - Developing different types of patterns - Transforming drawing measurement to a sheet metal - Obtaining forming allowances **Theories:** The student should explain: - The properties of material (metal) - Transformation of measurements from drawing to a sheet metal - Construction of geometrical figures - Development techniques of cylinder, cylinder with oblique top and cones **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while performing sheet metal works - Development techniques of cylinder, cylinder with oblique top and cones	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Drawing equipment (pencils, rulers, compasses, protractors) - Working drawings - Measuring tape - Try square - Hammer - Scriber - Grooving tools - Bending machine - Leather apron - Industrial boots	83

		(b) Fabricating an off-set cone	**Practical Work:** The instructor demonstrates fabricating an offset cone, highlighting how to develop and cut the pattern for an oblique cone **Practical Work:** The students practice cutting and assembling their cone from the sheet metal, ensuring the correct dimensions	The student should be able to - Calculate the allowances for the offset cone - Develop the pattern for an offset cone and cut the metal accordingly - Assemble and form the cone as per drawing specifications	The fabricated offset cone should have the correct angle, dimensions, and smooth edges	**Knowledge Evidence:** Detailed knowledge of: - Developing and cutting offset cone patterns - Principles of cutting and forming sheet metal - Calculating allowances for offset cone fabrication **Principles:** The student should explain the principles of: - Developing different types of patterns - Transforming drawing measurement to a sheet metal - Obtaining forming allowances **Theories:** The student should explain: - The properties of material (metal) - Transformation of measurements from drawing to a sheet metal - Construction of geometrical figures - Development techniques of cylinder, cylinder with oblique top and cones **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while performing sheet metal works - Development techniques of cylinder, cylinder with oblique top and cones	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Bending machine - Seaming machine - Cutting machine - Forming tools - Leather gloves - Industrial boots	

	2.2 Fabricate Structures of Steel Profiles	(a) Fabricating Casement Window	**Demonstration:** The instructor shows how to interpret the working drawings, select steel profiles, cut to the specified dimensions, and assemble the casement window **Practical Work:** The students practice fabricating the casement window, checking the alignment and dimensions	The student should be able to; - Interpret the working drawing of a casement window - Select the appropriate steel profiles and accessories - Cut, assemble, and fabricate the casement window	The casement window should conform to the specified dimensions and assembly instructions in the working drawing	**Knowledge Evidence:** Detailed knowledge of: - Methods to assemble structures like casement windows - Metal cutting, drilling, bending, and welding principles **Principles:** The student should explain the principles of: - Metal cutting/Drilling/Bending/Rolling - Filing/grinding - Riveting/Punching / welding **Theories:** The student should explain: - Main parts of cutting equipment - Types of cutting/Drilling/Bending/Rolling and punching machines - Steel profiles **Circumstantial Knowledge:** **Detailed knowledge about:** - Safety precautions to be observed when cutting, handling profiles, and glass panels - Principle of Metal cutting/Drilling/Bending/Rolling	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Steel profile cutting machine - Welding machine - Bending machine - Safety goggles - Welding/gas goggles - Gloves - Steel profiles - Scriber - Try square	66

		(b) Fabricating casement doors	**Practical Work:** The instructor demonstrates the steps for fabricating a casement door using the same techniques as the casement window **Practical Work:** The students practise fabricating the door with accurate measurements and proper welding or riveting techniques	The student should be able to: - Cut and shape steel profiles to create the casement door frame - Assemble and attach the door hardware (hinges, locks, etc)	The casement door should be assembled, welded or riveted according to technical specifications, with correct dimensions and functional hardware	**Knowledge Evidence:** Detailed knowledge of: - Types of metal joining methods used (e g , welding, riveting) - Cutting and bending techniques for creating the doorframe **Principles:** The student should explain the principles of: - Metal cutting/Drilling/Bending/Rolling - Filing/grinding - Riveting/Punching / welding **Theories:** The student should explain: - Main parts of cutting equipment - Types of cutting/Drilling/Bending/Rolling and punching machines - Steel profiles **Circumstantial Knowledge:** **Detailed knowledge about:** - Safety precautions to be observed when cutting, handling profiles, and glass panels - Principle of Metal cutting/Drilling/Bending/Rolling	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Welding machine - Riveting tools - Steel profile cutting machine - Try square - Mallet hammer - Safety boots

(c) Fabricating chair and table	**Demonstration and Practical Work:** The instructor demonstrates fabricating a chair and table using cutting, bending, and welding techniques **Practical Work:** The students practice assembling the chair and table, ensuring proper balance and strength	The student should be able to: - Measure and cut steel profiles accurately for the table and chair - Weld and assemble parts according to the design specifications	The fabricated chair and table should be structurally sound, with correct dimensions and assembled properly according to the design	**Knowledge Evidence:** Detailed knowledge of: - Steel profile measurements for furniture fabrication - Welded and riveted assembly of metal furniture **Principles:** The student should explain the principles of: - Metal cutting/Drilling/Bending/Rolling - Filing/grinding - Riveting/Punching / welding **Theories:** The student should explain: - Main parts of cutting equipment - Types of cutting/Drilling/Bending/Rolling and punching machines - Steel profiles **Circumstantial Knowledge:** **Detailed knowledge about:** - Safety precautions to be observed when cutting, handling profiles, and glass panels - Principle of Metal cutting/Drilling/Bending/Rolling	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Welding machine - Bending machine - Drilling machine - Spanner kit box - Welding/gas goggles - Gloves

		(d) Fabricating beds and cupboards	**Practical Work:** The students practise fabricating steel profiles to make beds and cupboards, using welding, cutting, and assembling techniques **Instructor Guidance:** The instructor demonstrates proper techniques for joining metal profiles, including using rivets and welding	The student should be able to: - Follow drawings to fabricate the bed and cupboard with accurate dimensions - Use various tools like the welding machine and spanner kit for assembly	The fabricated bed and cupboard should have correct dimensions, sturdy structure, and smooth finishes	**Knowledge Evidence:** Detailed knowledge of: - Properties of steel profiles used for furniture fabrication - Metal cutting, welding, and assembling techniques **Principles:** The student should explain the principles of: - Metal cutting/Drilling/Bending/Rolling - Filing/grinding - Riveting/Punching / welding **Theories:** The student should explain: - Main parts of cutting equipment - Types of cutting/Drilling/Bending/Rolling and punching machines - Steel profiles **Circumstantial Knowledge:** **Detailed knowledge about:** - Safety precautions to be observed when cutting, handling profiles, and glass panels - Principle of Metal cutting/Drilling/Bending/Rolling	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Steel profile cutting machine - Welding machine - Bending machine - Spanner kit - Safety boots - Apron

		(e) Erecting Steel Construction	**Demonstration and Practical Work:** The instructor demonstrates how to read steel construction blueprints and assemble steel structures **Practical Work:** The students practise assembling steel framework according to specifications	The student should be able to: - Interpret steel construction drawings accurately - Erect steel structures with precision, following safety and quality standards	The steel structure should conform to the technical drawing specifications with precise alignment, correct	**Knowledge Evidence** The students should explain: - Erection methods including bolting, welding, and riveting - Alignment and leveling techniques to ensure the structure is correctly positioned and balanced - Use of lifting equipment like cranes and chain blocks for hoisting and positioning steel components **Principles:** The student should explain the principles of: - Metal cutting/Drilling/Bending/Rolling - Filing/grinding - Riveting/Punching / welding - **Theories:** The student should explain: - Main parts of cutting equipment - Types of cutting/Drilling/Bending/Rolling and punching machines - Steel profiles **Circumstantial Knowledge:** **Detailed knowledge about:** - Safety precautions to be observed when cutting, handling profiles, and glass panels - Principle of Metal cutting/Drilling/Bending/Rolling -	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Hands-on experience in erecting steel structures under the supervision of an experienced professional. - Cranes, chain blocks, welding machines, grinders, drilling machines, lifting slings, and safety gear (gloves, goggles, boots, and harnesses).	

	2.3 Fabricate Structures of Aluminum Profiles	(a) Fabricating aluminum sliding window	**Demonstration and Practical Work:** The instructor demonstrates how to interpret working drawings for aluminum profiles, cut the profiles, and assemble the sliding window The students practise cutting, assembly, and fitting of glass panels	The student should be able to: - Interpret the working drawing of an aluminum sliding window - Select appropriate aluminum profiles - Cut and assemble the frame accurately - Fit the glass panel	The sliding window should conform to technical specifications, with the correct profile dimensions, assembled frame, and glass fitting	**Knowledge Evidence:** Detailed knowledge of: - Aluminum profile cutting and assembly methods - Glass fitting techniques **Principles:** The students should explain the principles of: - Metal and glass cutting - Aluminum joints - Filing and drilling - Riveting **Theories:** The students should explain: - Main parts of cutting equipment - Types of cutting tools - Aluminium sliding window **Circumstantial Knowledge:** **Detailed knowledge about:** - Safety precautions to be observed when cutting and handling profiles and glass panels - Aluminum sliding window and joint	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Aluminum profile cutting machine - Pop riveting machine - Glass cutter - Portable drilling machine - Safety goggles - Gloves	83

		(b) Fabricating aluminum doors	**Practical Work:** The instructor demonstrates the steps for fabricating aluminum doors, including cutting profiles, assembling frames, and fitting glass The students practise fabricating the door, checking dimensions, and performing the assembly	The student should be able to: - Cut and assemble aluminum profiles for the door - Fit and secure the glass panel within the frame - Fit the door in place	The fabricated aluminum door should be structurally sound, with proper frame alignment and correct fitting of glass panels	**Knowledge Evidence:** Detailed knowledge of: - Aluminum profile assembly techniques - Door fitting techniques and structural considerations **Principles:** The students should explain the principles of: - Metal and glass cutting - Aluminum joints - Filing and drilling - Riveting **Theories:** The students should explain: - Main parts of cutting equipment - Types of cutting tools - Aluminium doors **Circumstantial Knowledge:** **Detailed knowledge about:** - Safety precautions to be observed when cutting and handling profiles and glass panels - Aluminum door joints	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Aluminum profile cutting machine - Pop riveting machine - Screwdrivers - Safety boots - Face mask

		(c) Fabricating aluminum showcases	**Practical Work:** The students practise fabricating aluminum showcases using cutting, riveting, and glass fitting techniques, while observing safety practices and ensuring correct dimensions	The student should be able to: - Follow the working drawing to fabricate the aluminum frame - Select and cut appropriate aluminum profiles - Fit and secure the glass panels	The fabricated showcase should meet the specifications, with precise cutting, secure glass panels, and solid frame assembly	**Knowledge Evidence:** Detailed knowledge of: - Assembly methods for frames and glass - Cutting, filing, and riveting aluminum **Principles:** The students should explain the principles of: - Metal and glass cutting - Aluminum joints - Filing and drilling - Riveting **Theories:** The students should explain: - Main parts of cutting equipment - Types of cutting tools - Aluminum show cases **Circumstantial Knowledge:** **Detailed knowledge about:** - Safety precautions to be observed when cutting and handling profiles and glass panels - Aluminum show cases	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Pop riveting machine - Metal snips - Glass cutter - Mallet hammer - Plastic hammer - Safety goggles	
3.0 Performing Site Installation Involving Welding	3.1 Carrying Out Welding Works of Steel Structures	(a) Fabricate/weld a steel truss	**Demonstration and Practical Work:** The instructor demonstrates the process of welding a steel truss, covering preparation, welding technique, and inspection The students practise welding steel trusses,	The student should be able to: - Prepare materials for welding - Select appropriate electrodes and set the recommended current - Weld the steel structure and ensure	The welded steel truss should conform to the technical specifications, with strong and clean welds, no defects, and correctly dimensioned	**Knowledge Evidence:** Detailed knowledge of: - Steel truss welding techniques - Erecting steel structures at work sites - Proper electrode angle and arc length control **Principles:** The students should explain the principles of: - Taking different measurements and calculating allowances when welding structures - Procedure of erecting steel structures **Theories:** The students should explain: - Safety applied to steel structure	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Steel profile cutting machine - Welding machine	170

			including de-slagging and cleaning the welds	proper angle, arc length, and travel speed		works - Different types of steel profiles - Marking different metal profiles - Methods used to assemble steel structures - The equipment and tools used for welding steel structures - The properties of metals - How to control misalignment - Weld metal defects and how to avoid them **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while welding steel truss - Use of assembling tools (power tools)	- Grinding machine - Drilling machine - Chain block - Lifting slings - Safety goggles - Welding/gas goggles	
		(b) Fasten a fabricated metal frame pole by expansion raw bolts	**Practical Work:** The instructor demonstrates the process of fastening a metal frame pole using expansion raw bolts, explaining the necessary measurements and safety precautions The students practise fastening metal poles following correct procedures	The student should be able to: - Correctly measure and mark locations for raw bolts - Fasten the frame pole securely, ensuring that the bolts are applied correctly	The fastened metal frame pole should be secure, with all bolts correctly positioned and tightened	**Knowledge Evidence:** Detailed knowledge of: - Fastening techniques using expansion raw bolts - Measuring and marking procedures for metal frame poles **Principles:** The students should explain the principles of: - Taking different measurements and calculating allowances when welding structures - Procedure of erecting steel structures **Theories:** The students should explain: - Safety applied to steel structure works - Different types of steel profiles - Marking different metal profiles - Methods used to assemble steel structures	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Spanner kit box - Safety boots - Apron - Lifting slings	

						- The equipment and tools used for welding steel structures - The properties of metals - How to control misalignment - Weld metal defects and how to avoid them **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while fastering steel structures		
		(c) Install and repair chute and hopper	**Practical Work:** The instructor demonstrates the installation and repair of a chute and hopper, covering welding, assembly, and inspection The students practise installing and repairing a chute and hopper following technical specifications	The student should be able to: - Correctly install and repair a chute and hopper by following the drawings and welding it securely	The installed and repaired chute and hopper should conform to technical specifications, with all components securely welded and assembled	**Knowledge Evidence:** Detailed knowledge of: - Installation and repair procedures for chutes and hoppers - Weld techniques for industrial structures **Principles:** The students should explain the principles of: - Taking different measurements and calculating allowances when welding structures - Procedure of erecting steel structures **Theories:** The students should explain: - Safety applied to steel structure works - Different types of steel profiles - Marking different metal profiles - Methods used to assemble steel structures - The equipment and tools used for welding steel structures - The properties of metals - How to control misalignment - Weld metal defects and how to avoid them **Circumstantial knowledge:**	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Welding machine - Grinding machine - Safety goggles - Work bench	

						Detailed knowledge about: - Safety precautions to be observed while installing and repair hoppers - Use of assembling tools (power tools)		
4.0 Performing Resistance Welding	4.1 Carrying Out Resistance Welding on Sheet Metals	(a) Welding Sheet Metal Using Resistance Spots	**Demonstration and Practical Work:** The instructor demonstrates the process of welding sheet metal using resistance spot welding The students practise welding different thicknesses of sheet metal using appropriate settings	The student should be able to: - Set up the resistance welding machine and adjust current, squeeze time, weld time, hold time, and off period time - Carry out spot welding on sheet metal with proper electrode maintenance	The welded sheet metal should meet technical specifications with clean, uniform welds and no defects	**Knowledge Evidence:** Detailed knowledge of: Methods - Resistance welding methods (spot, seam, and flush) - Importance of electrode maintenance and grinding techniques **Principles:** The students should explain the principles of: - Resistance welding - Cleaning and maintaining electrode rollers after each work piece is welded - Grinding and cleaning copper electrodes - Aligning equidistantly the two work pieces on chucks **Theories:** The students should explain: - The main parts of resistance welding equipment and their functions - The working principle of resistance welding equipment - The importance of setting suitable current and time according to plate thickness - The meaning and difference between hold times, squeeze time and off period time - Requirement and quantities of resistance welding electrodes - Resistance welding variables	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Resistance welding machine - Work bench - Measuring tape - Safety boots - Clear goggles	81

						- Selection of resistance welding process - Joint design - Metallurgical effects on weldment **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while welding - The working principle of resistance welding equipment		
		(b) Welding Sheet Metal Using Resistance Seam	**Practical Work:** The students practise welding sheet metal using the resistance seam welding method, adjusting machine settings to suit the material	The student should be able to: - Set machine parameters correctly for seam welding - Weld sheet metal in seams with consistent results	The seam welds should be continuous, with no breaks, and the joint should be uniform and structurally sound	**Knowledge Evidence:** Detailed knowledge of: - Resistance seam welding and settings required for different sheet metal thicknesses **Principles:** The student should explain the principles of: - Resistance welding. - Cleaning and maintaining electrode rollers after each work piece is welded. - Grinding and cleaning copper electrodes. - Aligning equidistantly the two work pieces on chucks. **Theories:** The student should explain: - The main parts of resistance welding equipment and their functions. - The working principle of resistance welding equipment. - The importance of setting suitable current and time according to plate thickness. - The meaning and difference between hold times, squeeze time	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Resistance welding machine - Wire brush - Flat files - Safety goggles - Leather gloves	

						and off period time. - Requirement and quantities of resistance welding electrodes. - Resistance welding variables - Selection of resistance welding process. - Joint design. - Metallurgical effects on weldment. **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while welding. - The working principle of resistance welding equipment.		
		(c) Welding round bar using resistance flush welding	**Practical Work:** The Instructor demonstrates resistance flush welding on round bars, explaining electrode pressure and welding time The students practise welding round bars, ensuring good contact and no defects	The student should be able to: - Adjust machine settings for flush welding on round bars - Execute a flush weld with the correct pressure and time	The welded round bar should have a smooth, even weld, with no defects such as burn-through or misalignment	**Knowledge Evidence:** Detailed knowledge of: - Resistance flush welding process for round bars - Welding equipment and settings for round bars **Principles:** The student should explain the principles of: - Resistance welding. - Cleaning and maintaining electrode rollers after each work piece is welded. - Grinding and cleaning copper electrodes. - Aligning equidistantly the two work pieces on chucks. **Theories:** The student should explain: - The main parts of resistance welding equipment and their functions. - The working principle of resistance welding equipment. - The importance of setting suitable	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available - Resistance welding machine - Tongs - Safety boots - Leather gloves	

						current and time according to plate thickness. - The meaning and difference between hold times, squeeze time and off period time. - Requirement and quantities of resistance welding electrodes. - Resistance welding variables - Selection of resistance welding process. - Joint design. - Metallurgical effects on weldment. **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while welding. - The working principle of resistance welding equipment.		

Form Four

Table 6: *Detailed Contents for Form Four*

Module Title (Main Competence)	Unit Title (Specific Competences)	Elements (Learning Activities)	Suggested Teaching and Learning Methods	Assessment Criteria			Training Requirements/ Suggested Resources	Number of Periods per Unit
				Process Assessment	Service Assessment	Knowledge Assessment		
1.0. Performing arc welding on ferrous and non ferrous metals	1.1. Carrying out arc welding on non-ferrous metals	(a)Weld aluminium metals	**Demonstration:** The instructor demonstrates how to weld aluminum arc welding focusing on controlling heat and selecting the proper electrode, maintaining angle and arc length **Practical Work: The instructor** demonstrates welding of aluminum, showing the, techniques and procedure of aluminum welding	**The student should be able to:** • Inspect the ARC machine, cables and electrode holder • Interpret work drawings • Prepare aluminum materials for welding • Set recommended working current • Select type and size of electrode for the job • Align aluminum work pieces • Tack weld • Apply striking technique • • Weld the work piece • Maintain electrode angle and ARC length • Control	Welded aluminum metal conforms to technical specifications	**Knowledge Evidence Detailed knowledge of:** **Method used:** The student should explain the welding technique used **Principles:** The student should explain the principles of: • Welding aluminum metals • Properties of aluminum metals **Theories:** The student should explain: • Electrode identification • Properties of aluminum materials • Metallurgy of materials (Basic) • Joint design • Weld defects • Welding procedure and polarities	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Welding machine • welding shield • Welding cables • Earth Clamp • Electrode holder • Chipping hammer • Clear goggles • Wire brush • Work bench • Tongs • Angle grinder 4” • Flat file • Bench vice	**46**

			Practical Work: The students practise welding aluminum, ensuring they adjust the current to prevent overheating and follow correct electrode movement **Activity:** Organize the students to practise welding aluminum maintaining proper current settings and travelling speed on aluminum plate	electrode travel speed along the joint • Control distortion and warp age • Avoid weld defect • Clean work place, tools and equipment • Store tools and equipment safely		**Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while performing welding task aluminum metal - Welding procedures on aluminum metals	• Tape measure • Scriber • Ball peen hammer • Center punch • Leather apron • Respiratory mask • Leather gloves • Overalls • Clear goggles • Industrial boots	
		(b). Weld copper metals metals	**Demonstration:** The instructor demonstrates how to weld copper arc welding focusing on controlling heat and selecting the proper electrode, maintaining	**The student should be able to:** • Inspect the ARC machine, cables and electrode holder • Interpret work drawings • Prepare copper materials for welding	Welded copper metal conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the welding technique used **Principles:** The student should explain the principles of:	This element can be achieved at a work place or training institution The following tools, equipment and safety gear are to be available • Welding	

			angle and arc length **Practical Work: The instructor** demonstrates welding of copper, showing the correct current settings, techniques and procedure of copper welding **Practical Work: The** students practise welding copper, ensuring they adjust the current to prevent overheating and follow correct electrode movement **Activity:** Organize the students to practise welding copper maintaining proper current settings and travelling speed on copper plate	• Set recommended working current • Select type and size of electrode for the job • Align copper work pieces • Tack weld • Apply striking technique • • Weld the work piece • Maintain electrode angle and ARC length • Control electrode travel speed along the joint • Control distortion and warp age • Avoid weld defect • Clean work place, tools and equipment • Store tools and equipment safely		• Welding copper metals • Properties of copper metals **Theories:** The student should explain: • Electrode identification • Properties of copper materials • Metallurgy of materials (Basic) • Joint design • Weld defects • Welding procedure and polarities **Circumstantial knowledge: Detailed knowledge about:** • Safety precautions to be observed while performing welding task copper metal • Welding procedures on copper metals	machine • welding shield • Welding cables • Earth Clamp • Electrode holder • Chipping hammer • Clear goggles • Wire brush • Work bench • Tongs • Angle grinder 4” • Flat file • Bench vice • Tape measure • Scriber • Ball peen hammer • Center punch • Leather apron • Respiratory mask • Leather gloves • Overalls • Clear goggles • Industrial boots	

	1.2. Carrying out arc welding on high pressure vessels	(a). Weld high tensile steel plate in 3G and 4G position	**Demonstration:** The instructor demonstrates how to weld high tensile steel arc welding in 3G and 4G position focusing on controlling heat and selecting the proper electrode, maintaining angle and arc length **Practical Work: The instructor** demonstrates welding of high tensile steel, showing the correct current settings, techniques and procedure of high tensile steel welding in3G and 4G position **Practical Work: The** students practise welding high tensile steel in 3G and 4G	**The student should be able to:** • Inspect the machine, cable and electrode holder • Interpret work drawing • Prepare materials for welding • Set recommended working current • Select correct type/size of electrode for the job • Align work pieces and tack weld • Apply striking techniques and weld the metal • Maintain electrode angle and arc length • Control electrode travel speed along the joint • Control distortion and warp age • Avoid weld defects • Clean workplace, tools and equipment • Store tools and equipment safely	Welded high tensile steel vessel conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain: • The welding technique used • High tensile steel Welding procedures **Principles:** The student should explain the principles of: • Welding high pressure vessels • Heat treatment **Theories:** The student should explain: • Properties of high tensile steel • Metallurgy of materials (Basics) • Identification of materials • Joint design • Welding polarities and application - Welding defects - Heat and temperature relating to welding **Circumstantial knowledge:** **Detailed knowledge about:** - Safety	This element can be achieved at a work place or training institution The following tools, equipment and safety gear are to be available • Welding machine (AC/DC) • Welding cables • Earth clamps • Welding shield • Chipping hammer • Wire brush • Work bench • Tongs • Angle grinder • Bench vice • Flat file • Tape measure • Scriber • Align clamps • Hammer • Center punch • Leather Apron • • Leather gloves • Industrial boots • Clear goggles • Canvas spats	**46**

		position , ensuring they adjust the current to prevent overheating and follow correct electrode movement **Activity:** Organize the students to practise welding high tensile steel in 3G and 4G position maintaining proper current settings and travelling speed on high tensile steel plate			precautions to be observed while welding high-pressure vessels - Pre - heating and post heating procedures	• Steel rule	
	(b) Weld high tensile steel pipe in 2G, 5G, 6G and 6GR position.	**Demonstration:** The instructor demonstrates how to weld high tensile steel pipe arc welding in 2G, 5G, 6G and 6R position position focusing on controlling heat and selecting the proper electrode, maintaining	**The student should be able to:** • Inspect the machine, cable and electrode holder • Interpret work drawing • Prepare materials for welding • Set recommended working current • Select correct type/size of electrode for the	Welded high tensile steel pipe conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain: • The welding technique used • High tensile steel pipe Welding procedures **Principles:** The student should explain the principles of:	This element can be achieved at a work place or training institution The following tools, equipment and safety gear are to be available: • Welding machine (AC/DC) • Welding cables	

			angle and arc length **Practical Work: The instructor** demonstrates welding of high tensile steel pipe, showing the correct current settings ,techniques and procedure of high tensile steel pipe welding in 2G, 5G, 6G and 6R position **Practical Work: The** students practice welding high tensile steel pipe in 2G, 5G, 6G and 6R position position , ensuring they adjust the current to prevent overheating and follow correct electrode movement **Activity:** Organize the Students to practise welding	job • Align work pieces and tack weld • Apply striking techniques and weld the metal • Maintain electrode angle and arc length • Control electrode travel speed along the joint • Control distortion and warp age • Avoid weld defects • Clean workplace, tools and equipment • Store tools and equipment safely		• Welding high-pressure vessels • Heat treatment **Theories:** The student should explain: • Properties of high tensile steel pipe • Metallurgy of materials (Basics) • Identification of materials • Joint design • Welding polarities and application • Welding defects • Heat and temperature relating to welding **Circumstantial knowledge: Detailed knowledge about:** • Safety precautions to be observed while welding high pressure vessels • Pre - heating and post heating procedures	• Earth clamps • Welding shield • Chipping hammer • Wire brush • Work bench • Tongs • Angle grinder • Bench vice • Flat file • Tape measure • Scriber • Align clamps • Hammer • Center punch • Leather Apron • • Leather gloves • Industrial boots • Clear goggles • Canvas spats • Steel rule	

			high tensile steel pipe in 2G, 5G, 6G and 6R position position maintaining proper current settings and travelling speed on high tensile steel pipe plate					
	1.3. Carrying out welding of steel structures	(a). Fabricate casement window, door and tented frame.	**Demonstration: The instructor** demonstrates the process of fabricating a casement window, door and tented frame, including interpreting working drawings, selecting materials, and cutting the materials **Practical Work: The students** practise measuring, marking, and cutting metal according to technical specifications **Practical**	**The student should be able to:** • Inspect the machine, cable and electrode holder • Interpret working drawing • Calculate allowances and position of holes • Prepare materials for welding • Set recommended current • Select type and size of electrode • Align work pieces and tack weld • Apply striking technique and weld the metal • Maintain electrode angle and arc length • Control electrode travel speed along the joint • Control distortion and warp age	Welded casement window, door and tented frame conforms to technical specifications	**Knowledge Evidence Detailed knowledge of:** **Method used:** The student should explain joining and welding technique used **Principles:** The student should explain the principles of: • Welding and installation of structure steel • Principles of erecting support column **Theories:** The student should explain: • Profile of metal structures • Calculation of span related to steel structures • Metallurgy of materials (Basic) • Identification of materials • Joint design • Welding procedures	This element can be achieved at a work place or training institution The following tools, equipment, and safety gear are to be available • Steel profile cutting machine • Rolling machine • punching machine • Bending machine • Welding machine • Grinding machine • Drilling machine • Spanner kit box • Chain blocks • Lifting	**96**

			Work: The instructor demonstrates fabricating a casement window, door and tented frame how to cut the materials for fabricating **Practical Work: The students** practise cutting and assembling casement window, door and tented frame Ensuring the correct dimensions	• Avoid weld defects • Clean workplace, tools and equipment • Store tools and equipment safety		• Tension joints • Welding defects • Technical drawing skills **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while welding steel structures - Proportionality of materials weight and structure	equipment • Oxy acetylene plant/cutting nozzles • Air compressor • Steel rule • Scriber • Try square • Mallet hammer • Ball pein hammer • Safety goggles • Welding/gas goggles • Gloves • Safety boots • Apron • Chain block • Lifting slings and shackles • Center punch • Leather Apron • Tape measure • Leather gloves • Overalls • Industrial boots • Clear goggles • Canvas spats • Steel rule	
		(b). Fabricate a support column	**Demonstration: The instructor** demonstrates the process of fabricating a support column including interpreting	**The student should be able to:** • Inspect the machine, cable and electrode holder • Interpret working drawing • Calculate	Welded support column conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain joining and welding technique used **Principles:** The	This element can be achieved at a work place or training institution The following tools, equipment, and safety gear	

				working drawings, selecting materials, and cutting the materials **Practical Work: The students** practise measuring, marking, and cutting metal according to technical specifications **Practical Work: The instructor** demonstrates fabricating a support column and how to cut the materials for fabricating **Practical Work: The students** practise cutting and assembling support column Ensuring the correct dimensions	allowances and position of holes • Prepare materials for welding • Set recommended current • Select the type and size of the electrode • Align workpieces and tack weld • Apply striking technique and weld the metal • Maintain electrode angle and arc length • Control electrode travel speed along the joint • Control distortion and warp age • Avoid weld defects • Clean workplace, tools and equipment • Store tools and equipment safety		student should explain the principles of: • Welding and installation of support column - Principles of erecting support column **Theories:** The student should explain: • Profile of metal structures • Calculation of span related to support column • Metallurgy of materials (Basic) • Identification of materials • Joint design • Welding procedures • Tension joints • Welding defects • Technical drawing skills **Circumstantial knowledge: Detailed knowledge about:** - Safety precautions to be observed while welding support column and erecting support column - Proportionality of materials weight	are to be available • Steel profile cutting machine • Rolling machine • punching machine • Bending machine • Welding machine • Grinding machine • Drilling machine • Spanner kit box • Chain blocks • Lifting equipment • Oxy acetylene plant/cutting nozzles • Air compressor • Steel rule • Scriber • Try square • Mallet hammer • Ball peen hammer • Safety goggles • Welding/gas goggles • Gloves • Safety boots • Apron

						and support column	• Chain block • Lifting slings and shackles • Center punch • Leather Apron • Tape measure • Leather gloves • Overalls • Industrial boots • Clear goggles • Canvas spats • Steel rule
		(c). install steel structure	**Demonstration: The instructor** demonstrates the process of installing a steel structure, including interpreting working drawings and selecting the placement. **Practical Work: The students** practise measuring, marking, and install steel structure according to technical specifications **Practical**	**The student should be able to:** • Inspect the machine, cable and electrode holder • Interpret working drawing • Prepare materials for installing steel structure • Set recommended current • Select the type and the size of electrode • Align and install steel structure work pieces and tack weld • Apply striking technique and install steel structure • Maintain electrode angle and arc	Welded steel structure installed conforms to technical specifications	**Knowledge Evidence Detailed knowledge of:** **Method used:** The student should explain joining and welding technique used to install steel structure **Principles:** The student should explain the principles of: - Installation of structure steel **Theories:** The student should explain: - Profile of metal structures • Calculation of span related to steel structures • Identification of materials • Tension joints • Welding defects	This element can be achieved at a work place or training institution The following tools, equipment and safety gear are to be available • Welding machine • Grinding machine • Drilling machine • Oxy acetylene plant/cutting nozzles • Air compressor • Steel rule • Scriber • Try square • Mallet hammer • Ball peen	

			Work: The instructor demonstrates installing steel structure **Practical Work: The students** practise assembling and install steel structure	length • Control electrode travel speed along the joint • Control warp age • Avoid weld defects • Clean workplace, tools and equipment • Store tools and equipment safety		• Technical drawing skills **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while installing steel structure • Proportionality of material weights in installation of steel structure	hammer • Safety goggles • Welding/gas goggles • Gloves • Safety boots • Apron • Center punch • Leather Apron • Tape measure • Leather gloves • Overalls • Industrial boots • Clear goggles • Canvas spats • Steel rule	
	1.4. Carrying out laser-beam welding and cutting on metals	(a). Weld a plate by laser beam welding	**Demonstration:** The instructor demonstrates how to weld a plate by laser beam welding position focusing on controlling heat and Operate laser beam light source **Practical Work: The instructor** demonstrates welding of a plate by laser	**The student should be able to:** • Inspect welding machine • Interpret working drawings • Prepare metal for welding • File work piece to obtain groove required • Operate laser beam light source • Direct laser beam to work piece • Inspect weld metal defects • Clean tools and	Welded work piece conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain: • Laser beam Welding procedures and techniques used • Controlling methods of laser beam **Principles:** The student should explain the principles of: - Welding using laser beam **Theories:** The student	This element can be achieved at a work place or training institution The following tools, equipment and safety gear are to be available • Laser welding machine • Autos darken goggles • Welding shield • Set of drawing instruments • Marking tools	**36**

			beam, showing the correct laser beam light source settings, techniques, and laser beam welding Operate laser beam light source Direct laser beam to work piece and weld **Practical Work: The** students practise Operate laser beam light source Direct laser beam to work piece and weld a plate by laser beam welding **Activity:** Organize the students to prepare metal for laser beam welding weld a plate by laser beam	equipment • • Store tools and equipment safely		should explain: • The main parts and functions of laser beam welding machine • The meaning of laser beam **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while welding work piece using laser beam • Operational principles of laser welding machines	• Leather gloves • Leather apron • Overalls • Safety boots • Workbench • Tongs	
		(b). Perform cutting a plate by CNC-laser cutting machine.	**Demonstration:** The instructor Defines and explains CNC	**The student should be able to:** • Inspect welding machine	cut workpiece conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The	This element can be achieved at a work place or training	

			laser cutting machine Demonstrates how to cut a plate by laser beam CNC cutting machine Operate laser beam light source **Practical Work: The instructor** demonstrates procedures of cutting of a plate by laser beam, showing the correct laser beam light source settings, techniques of laser beam cutting Operate laser beam light source Direct laser beam to work piece and cut **Practical Work: The** students observe and practise Operate laser beam light cutting source Direct laser	• Interpret working drawings • Prepare metal for cutting • Operate laser beam light source • Direct laser beam to work piece • Inspect cut metal defects • Clean tools and equipment • • Store tools and equipment safely		student should explain: • Cutting procedures and techniques used • Controlling methods of laser beam **Principles:** The student should explain the principles of: - Operation of CNC- laser cutting machine **Theories:** The student should explain: • The main parts and functions of laser beam cutting machine • Types of laser Cutting machines - The meaning of laser beam **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while cutting work piece using laser beam • Operational principles of laser cutting machines	institution. The following tools, equipment, and safety gear are to be available: • CNC-Laser cutting machine • Autos darken goggles • Welding shield • Set of drawing instruments • Marking tools • Leather gloves • Leather apron • Overalls • Safety boots • Workbench • Tongs	

			beam to work piece and cut a plate by laser beam welding **Activity:** Organize the students to prepare metal for laser beam cutting Cut a plate by laser beam CNC cutter					
2. Performing advanced gas welding on ferrous and non-ferrous metals	2.1. Carrying out gas welding on ferrous and non-ferrous metals.	(a). Weld cast iron	**Brain storm** Guide the students to: Define cast iron Explain Types of flames Main parts of oxy-acetylene plant and their functions Explain Operating principles of low and high pressure blow pipes **Practical works:** Explain and Demonstrate cast iron	**The student should be able to:** • Inspect gas-welding equipment • Assemble and disassemble gas cylinders • Select nozzle sizes • Select welding filler wires • Set working pressure • Cut and file sheet metal • Light the torch and adjust the correct welding flame • Align and tack weld work piece • Weld sheet metal • Maintain movement of blowpipe and filler material	Welded cast iron conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the welding technique used **Principles:** The student should explain the principles of: • Pressure and gas flame setting • Method used while weld cast iron • Low pressure blow pipe • High pressure blow pipe **Theories:** The student should explain: • Types of flames • Main parts of oxy-acetylene plant and their functions	This element can be achieved at a work place or training institution The following tools, equipment and safety gear are to be available • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipe • Gas trolley • Cylinder key • Blow pipe spanner • Spark lighter • Hammer • Chisel • Wire brush	**180**

			welding procedures Guide the students to: Interpret working drawing Prepare cast iron and cut to required sizes and specifications Light the torch and adjust the correct welding flame Maintain movement of blow pipe and filler material Weld cast iron in all positions **Activity:** Organize the students to Prepare materials and Performing Welding of cast iron using gas flame	• Check fusion on metals • Maintain orderliness of welding ripples • Check welding root penetration • Inspect quality of weld ripples • Clean work place, tools and equipment • Store tools and equipment safely		• Function of flash back arrestors and hose check valves • Operating principles of low and high pressure blow pipes • Different gas welding techniques • Storage of gas cylinders • Metallurgy of metals (basic) • Effect of Heat and temperature relating to welding **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while welding cas iron by gas • Metal warping due to high temperature	• Center punch • Gas PPE • Leather apron • Leather gloves • Industrial boots • Canvas spats • Tape measure • Steel rule	
		(b). Weld aluminium	**Brain storm** Guide the	**The student should be able to:** • Inspect gas-	Welded aluminum conforms to	**Knowledge Evidence** **Detailed knowledge of:**	This element can be achieved at a work place or	

				students to: Define aluminium Explain Types of flames Main parts of oxy-acetylene plant and their functions Explain Operating principles of low and high pressure blow pipes **Practical works:** Explain and Demonstrate aluminium welding procedures Guide the students to: Interpret working drawing Prepare cast iron and cut to required sizes and specifications Light the torch and adjust the correct welding flame	welding equipment • Assemble and disassemble gas cylinders • Select nozzle sizes • Select welding filler wires • Set working pressure • Cut and file sheet metal • Light the torch and adjust the correct welding flame • Align and tack weld aluminum work piece • Weld sheet metal • Maintain movement of blow pipe and filler material • Check fusion on metals • Maintain orderliness of welding ripples • Check welding root penetration • Inspect quality of weld ripples • Clean work place, tools and equipment • Store tools and equipment safely	technical specifications	**Method used:** The student should explain the welding technique used **Principles:** The student should explain the principles of: • Pressure and gas flame setting • Method used while weld aluminum • Low-pressure blow pipe • High pressure blow pipe **Theories:** The student should explain: • Types of flames • Main parts of oxy-acetylene plant and their functions • Function of flash back arrestors and hose check valves - Operating principles of low and high pressure blow pipes • Different gas welding techniques • Storage of gas cylinders • Metallurgy of metals (basic) • Effect of Heat and temperature relating to welding **Circumstantial knowledge:**	training institution The following tools, equipment and safety gear are to be available • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipe • Gas trolley • Cylinder key • Blow pipe spanner • Spark lighter • Hammer • Chisel • Wire brush • Center punch • Gas PPE • Leather apron • Leather gloves • Industrial boots • Canvas spats • Tape measure • Steel rule

			Maintain movement of blow pipe and filler material Weld aluminum by gas flame **Activity:** Organize the students to Prepare materials and Performing Welding of aluminum using gas flame			**Detailed knowledge about:** • Safety precautions to be observed while welding aluminum by gas welding • Metal warping due to high temperature	
		(c). Weld medium carbon steel	**Brain storm** Guide the students to: Define copper Explain Types of flames Main parts of oxy-acetylene plant and their functions Explain Operating principles of low and high pressure blow pipes **Practical**	**The student should be able to:** • Inspect gas-welding equipment • Assemble and disassemble gas cylinders • Select nozzle sizes • Select welding filler wires • Set working pressure • Cut and file sheet metal • Light the torch and adjust the correct welding flame • Align and tack weld work piece	Welded medium carbon steel conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the welding technique used **Principles:** The student should explain the principles of: • Pressure and gas flame setting • Method used while weld medium carbon steel • Low-pressure blow pipe • High pressure blow pipe	This element can be achieved at a work place or training institution The following tools, equipment, and safety gear are to be available • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipe • Gas trolley • Cylinder key • Blow pipe

				works: Explain and Demonstrate medium carbon steel welding procedures Guide the students to: Interpret working drawing Prepare medium carbon steel and cut to required sizes and specifications Light the torch and adjust the correct welding flame Maintain movement of blow pipe and filler material Weld medium carbon steel by gas flame **Activity:** Organize the students to Prepare medium carbon steel and Performing Welding of	• Weld sheet metal • Maintain movement of blow pipe and filler material • Check fusion on metals • Maintain orderliness of welding ripples • Check welding root penetration • Inspect quality of weld ripples • Clean work place, tools and equipment • Store tools and equipment safely		**Theories:** The student should explain: • Types of flames • Main parts of oxy-acetylene plant and their functions • Function of flash back arrestors and hose check valves • Operating principles of low and high pressure blow pipes • Different gas welding techniques • Storage of gas cylinders • Metallurgy of metals (basic) • Effect of Heat and temperature relating to welding **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while welding medium carbon steel by gas welding	spanner • Spark lighter • Hammer • Chisel • Wire brush • Center punch • Gas PPE • Leather apron • Leather gloves • Industrial boots • Canvas spats • Tape measure • Steel rule

			medium carbon steel using gas flame					
		(d). Weld medium carbon steel	**Brain storm** Guide the students to: Define medium carbon steel Explain Types of flames Main parts of oxy-acetylene plant and their functions Explain Operating principles of low and high pressure blow pipes **Practical works:** Explain and Demonstrate medium carbon steel welding procedures Guide the students to: Interpret working drawing Prepare medium	**The student should be able to:** • Inspect gas-welding equipment • Assemble and disassemble gas cylinders • Select nozzle sizes • Select welding filler wires • Set working pressure • Cut and file sheet metal • Light the torch and adjust the correct welding flame • Align and tack weld work piece • Weld sheet metal • Maintain movement of blow pipe and filler material • Check fusion on metals • Maintain orderliness of welding ripples • Check welding root penetration • Inspect quality of weld ripples • Clean work place,	Welded metal conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the welding technique used **Principles:** The student should explain the principles of: • Pressure and gas flame setting • Method used while weld medium carbon steel • Low pressure blow pipe • High pressure blow pipe **Theories:** The student should explain: • Types of flames • Main parts of oxy-acetylene plant and their functions • Function of flash back arrestors and hose check valves • Operating principles of low and high pressure blow pipes • Different gas welding techniques • Storage of gas cylinders	This unit can be achieved at a work place or training institution The following tools, equipment and safety gear are to be available • Oxy-acetylene plant • Pressure regulator • Welding torch • Hose pipe • Gas trolley • Cylinder key • Blow pipe spanner • Spark lighter • Hammer • Chisel • Wire brush • Center punch • Gas PPE • Leather apron • Leather gloves • Industrial boots • Canvas spats • Tape measure • Steel rule	

			carbon steel and cut to required sizes and specifications Light the torch and adjust the correct welding flame Maintain movement of blow pipe and filler material Weld medium carbon steel by gas flame **Activity:** Organize the students to Prepare medium carbon steel and Performing Welding of medium carbon steel using gas flame	tools and equipment • Store tools and equipment safely		• Metallurgy of metals (basic) • Effect of Heat and temperature relating to welding **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while welding medium carbon steel by gas welding • Metal warping due to high temperature		
3. Performing advanced gas flame cutting on ferrous metals	3.1. Carrying out gas flame cutting on ferrous metals	(a). Cutting steel plate by automatic machine flame cutting.	**Brain storm** Guide the students to: Define automatic machine flame cutting Explain automatic machine flame	**The student should be able to:** • Inspect gas-cutting equipment • Assemble gas cylinders • Assemble gas-cutting equipment on automatic machine flame cutting	Ferrous metal cut according to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain automatic gas cutting techniques **Principles:** The student should explain the principles of: • Cutting metal by	This unit can be achieved at a work place or training institution The following tools, equipment and safety gear are to be available: • Oxy-acetylene	**180**

			cutting techniques used and Safety precautions to be observed during automatic machine flame cutting **Practical works:** Explain and Demonstrate steel plate automatic machine flame cutting procedures Guide the students to: Interpret working drawing Mark the measurement to be cut Prepare metal and cut to required sizes and specifications Cut steel plate using automatic machine flame cutting **Activity:** Organize the students to	• Select nozzle sizes • Select recommended gas pressure • Align the cutting machine into position • Clamp the plate in position • Light the torch • Adjust the flames • Cut the metal • Extinguish the cutting flame • Inspect the cut edger (kerf) • Clean the work place • Clean gas cutting equipment and tools • Store tools and equipment at the required place		machine cutting • Obtaining smooth kerf • Setting correct gas pressure **Theories:** The student should explain: • Types of flames • Main parts of oxy-acetylene plant and their functions - Parts of automatic machine flame cutting • Recommended working pressure • Nozzle sizes according to plate thickness • Function of flash back arrestors and hose check valves • Operating principles of low and high pressure blow pipes • Types of Regulators • Storage of gas cylinders • Metallurgy of metals (basic) **Circumstantial knowledge:** **Detailed knowledge about:** Safety precautions to be observed while automatic machine	cutting plant • Gas cutting machine • Pressure regulator • Cutting torch • Centre punch • Leather gloves • Darken goggles • Ball pein hammer • Safety boot • Overall	

			Prepare metal plate and Cut a piece of mild steel plate from a bulk mild steel plate using automatic machine flame cutting			flame cutting - Operational adjustments during metal cutting		
		(b). Cutting steel plate by stack cutting.	**Brain storm** Guide the students to: Define stack cutting Explain stack cutting techniques used and Safety precautions to be observed while stack cutting **Practical works:** Explain and Demonstrate steel plate stack cutting procedures Guide the students to: Interpret working drawing Mark the plate measurement to be cut	**The student should be able to:** • Inspect gas-cutting equipment • Assemble gas cylinders • Assemble gas cutting equipment on automatic machine flame cutting • Select nozzle sizes • Select recommended gas pressure • Align the cutting machine into position • Clamp the plate in position • Light the torch • Adjust the flames • Cut the metal • Extinguish the cutting flame • Inspect the cut edger (kerf) • Clean the work place	Steel plate cut according to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain automatic gas cutting techniques **Principles:** The student should explain the principles of: - Cutting metal by stack - Obtaining smooth kerf - Setting correct gas pressure **Theories:** The student should explain: - Types of flames - Main parts of oxy-acetylene plant and their functions - Parts of gas cutting machine - Recommended working pressure - Nozzle sizes according to plate	This unit can be achieved at a work place or training institution The following tools, equipment and safety gear are to be available • Oxy-acetylene cutting plant • Gas cutting machine • Pressure regulator • Cutting torch • Centre punch • Leather gloves • Darken goggles • Ball pein hammer • Safety boot • Overall	

			Prepare metal and cut to required sizes and specifications Cutting steel plate using stack cutting **Activity:** Organize the students to Prepare metal plate and Cutting a piece of mild steel plate from a bulk mild steel plate using stack cutting	• Clean gas cutting equipment and tools • Store tools and equipment at the required place		thickness - Function of flash back arrestors and hose check valves • Operating principles of low and high pressure blow pipes • Types of Regulators • Storage of gas cylinders • Metallurgy of metals (basic) **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while stack cutting • Operational adjustments during metal cutting		
4. Performing metal spraying on metal surfaces	4.1. Carrying out metal spraying	(a). Rebuild a worn-out shaft	**Brainstorm:** Guide the students to define metal spraying, explain Rebuild a worn-out and explain metal spraying technique **Practical work:** Guide the student on how to perform rebuilding a	**The student should be able to:** • Inspect spray welding equipment • Identify and prepare work piece for spray welding • Clean surface for metal spraying • Select suitable spraying materials (wire/powder) • Clamp work piece firmly • Select suitable gas	The metal sprayed surface conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain metal spraying technique used **Principles:** The student should explain the principles of: • Metal spraying • Operation of metal spraying equipment • Selecting surfacing process	This element can be achieved at a work place or training institution The following tools, equipment and safety gear are to be available • Metal spraying machine • Air receiver tank • Fuel gas	**45**

			worn-out shaft **Activity:** Organize the students in manageable group to perform rebuilding a worn-out shaft	spraying nozzle • Operate machine and spray weld • Inspect quality of finished surface • Clean tools and equipment • Store tools and equipment safely		• Taking different measurements **Theories:** The student should explain: • Main parts of metal spraying equipment and their functions • Types of metals and their properties • Nature of wear problems • Heat treatment process • Heat and temperature taken for a job • Heat and temperature relating to welding **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be observed while doing the metal spraying work - Over fill and under fill the sprayed metal	oxygen regulator • Fuel gas oxygen cylinders • Gas flow meter • Compressed air control • Wire feeding control • Spraying gun • Tinted goggles • Leather gloves • Leather apron • Overalls • Safety boots • Wire brush • Work bench • Tongs • Angle grinder • Flat file • Bench vice • Vernier caliper	
5. Performing advanced fabrication and pipe works	5.1. Carrying out metal plate works	(a). Fabricating square to round chute	**Brainstorm:** Guide the students to define metal	**The student should be able to:** • Interpret working	Metal Plate fabricated to form square to round chute as	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The	This element can be achieved at a work place or training	**80**

			chute, explain how to fabricate square to round chute and explain technique used to fabricate a square metal sheet to round chute **Practical work:** Guide the student on how to fabricate a square metal sheet to round chute **Activity:** Organize the students in manageable group to perform fabrication of a square metal sheet to round chute	drawings • Take correct measurements • Prepare metal sheets for fabrication • Calculate allowances using formulae • Develop different types of patterns • Set sheet metal into a machine • Cut, bend and form metal sheets • Fabricate metal sheet-square to round chute, rectangle to round chute • Check for accuracy of shapes • Clean machines, tools and store safely	per technical specifications	student should explain the techniques used to: • Fabricate a square metal sheet to round chute **Principles:** The student should explain the principles of: • Developing different types of patterns • Transforming drawing measurements to sheet metals • Taking different measurement and perform calculations • Obtaining form allowances **Theories:** The student should explain: • Methods of fabricating metal plate • Methods of taking different measurements and calculations • Types of metals and their properties • Types of metal plate forming machines • Different types of metal plate works **Circumstantial**	institution The following tools, equipment and safety gear are to be available: • Working drawing • Measuring tape • Try square • Tools box • Hammer • Scriber • Grooving tools • Bending machine • Seaming machine • Cutting machine • Welding machine • Forming tools • Clear goggles • Leather apron • Overalls • Leather gloves • Industrial boots • Canvas spats	

						knowledge: **Detailed knowledge about:** • Safety precautions to be observed while doing the fabrication work • Handling of buckled and twisting of metal plate		
		(b). Fabricating a rectangle to round chute from metal plate	**Brainstorm:** Guide the students to define a rectangle to round chute, explain how to fabricate a rectangle to round chute and explain techniques used to fabricate a rectangle to round chute **Practical work:** Guide the students on how to fabricate a rectangle to round chute from metal plate **Activity:** Organize the students in manageable group to perform	**The student should be able to:** • Interpret working drawings • Take correct measurements • Prepare metal sheets for fabrication • Calculate allowances using formulae • Develop different types of patterns • Set sheet metal into a machine • Cut, bend and form metal sheets • • Fabricate a rectangle to round chute from metal plate • Check for accuracy of shapes • Clean machines,	Metal Plate fabricated rectangle to round chute as per technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the techniques used to: • Fabricate a rectangle metal sheet to round chute **Principles:** The student should explain the principles of: • Developing different types of patterns • Transforming drawing measurements to sheet metals • Taking different measurement and perform calculations • Obtaining form allowances **Theories:** The student	This element can be achieved at a work place or training institution The following tools, equipment, and safety gear are to be available • Working drawing • Measuring tape • Try square • Tools box • Hammer • Scriber • Grooving tools • Bending machine • Seaming machine • Cutting machine • Welding machine • Forming tools	

			fabrication of a rectangle to round chute from metal plate	tools and store safely		should explain: • Methods of fabricating a rectangle to round chute from metal plate • Methods of taking different measurements and calculations • Types of metals and their properties • Types of metal plate forming machines • Different types of metal plate works **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while doing the fabrication a rectangle to round chute from metal plate work • Handling of buckled and twisting of metal plate	• Clear goggles • Leather apron • Overalls • Leather gloves • Industrial boots • Canvas spats
			(c). Fabricating radial door	**Brainstorm:** Guide the students to define a radial door, explain how to fabricate a radial door and explain techniques used	**The student should be able to:** • Interpret working drawings • Take correct measurements • Prepare metal sheets for fabrication	Radial door fabricated as per technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the techniques used to: • Fabricate a radial	This element can be achieved at a work place or training institution The following tools, equipment and safety gear are to be

				to fabricate a radial door **Practical work:** Guide the student on how to fabricate a radial door **Activity:** Organize the students in manageable groups to perform fabrication of a radial door	• Calculate allowances using formulae • Develop different types of patterns • Set sheet metal into a machine • Cut, bend and form metal sheets • Fabricate radial door • Check for accuracy of shapes • Clean machines, tools and store safely		door **Principles:** The student should explain the principles of: • Transforming drawing measurements to sheet metals • Taking different measurement and perform calculations • Obtaining form allowances **Theories:** The student should explain: • Methods of fabricating a radial door • Methods of taking different measurements and calculations • Types of metals and their properties • Types of metal plate forming machines • Different types of metal plate works **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while doing the fabrication a radial	available • Working drawing • Measuring tape • Try square • Tools box • Hammer • Scriber • Grooving tools • Bending machine • Seaming machine • Cutting machine • Welding machine • Forming tools • Clear goggles • Leather apron • Overalls • Leather gloves • Industrial boots • Canvas spats

					door		
	(d). Fabricate an off -centre chute.	**Brainstorm:** Guide the students to define an off -centre chute, explain how to fabricate an off -centre chute and explain techniques used to fabricate an off -centre chute **Practical work:** Guide the student on how to fabricate an off -centre chute **Activity:** Organize the students in manageable groups to perform fabrication of an off-centre chute	**The student should be able to:** • Interpret working drawings • Take correct measurements • Prepare metal sheets for fabrication • Calculate allowances using formulae • Develop different types of patterns • Set sheet metal into a machine • Cut, bend and form metal sheets • Fabricate an off -centre chute • Check for accuracy of shapes • Clean machines, tools and store safely	Metal Plate fabricated to form an off -centre chute as per technical specifications	**Knowledge Evidence Detailed knowledge of:** **Method used:** The student should explain the techniques used to: • Fabricate an off -centre chute **Principles:** The student should explain the principles of: • Developing different types of patterns • Transforming drawing measurements to sheet metals • Taking different measurement and perform calculations • Obtaining form allowances **Theories:** The student should explain: • Methods of fabricating an off -centre chute • Methods of taking different measurements and calculations • Types of metals and their properties • Types of metal plate	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Working drawing • Measuring tape • Try square • Tools box • Hammer • Scriber • Grooving tools • Bending machine • Seaming machine • Cutting machine • Welding machine • Forming tools • Clear goggles • Leather apron • Overalls • Leather gloves • Industrial boots • Canvas spats	

						forming machines • Different types of metal plate works **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while doing the fabrication an off - centre chute • Handling of buckled and twisting of metal plate		
	5.2. Carrying out welding pipe works	(a). Performing fabrication of pipe elbow	**Brainstorm:** Guide the students to define pipe elbow, explain how to fabricate pipe elbow, and explain techniques used to fabricate pipe elbow **Practical work:** Guide the student on how to fabricate pipe elbow **Activity:** Organize the students in manageable group to perform	**The student should be able to:** • Interpret working drawings • Take correct measurements • Prepare pipe for fabrication • Calculate allowances using formulae • Develop different types of patterns • Set pipe into a machine • Cut, bend and form pipe • Check accuracy of shapes • Clean machines, tools and store safely	pipe elbow fabricated to form different angles as per requirements	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the techniques used to Fabricate pipe elbow into different shapes **Principles:** The student should explain the principles of: • Developing different types of patterns • Transforming drawing measurements to pipe • Taking different measurement and perform calculations • Observe measurement and	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Working drawing • Measuring tape • Try square • Tools box • Ball peen Hammer • Scriber • Grooving tools • Bending machine • Seaming	**40**

		fabrication of pipe elbow			allowances **Theories:** The student should explain: • Types of pipes and their properties • Types of pipe forming machines • Different types of pipe sizes **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while doing the fabrication of pipe elbow work • Principles of paten development	machine • Gas Cutting plant • Arc welding Equipment • Cutting machine • Angle grinder • Forming tools • Contour mark • center finder • soap chalk • Prick punch • Spirit Level • Clear goggles • Leather apron • Overalls • Leather gloves • Industrial boots • Canvas spats	
	(b). Performing fabrication of lobster back bend	**Brainstorm:** Guide the students to define lobster back bend, explain how to fabricate lobster back bend and explain techniques used to fabricate lobster back bend	**The student should be able to:** • Interpret working drawings • Take correct measurements • Prepare pipe for fabrication • Calculate allowances using formulae • Develop different types of patterns • Set pipe into a machine	lobster back bend fabricated to form different angles as per requirements	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the techniques used to Fabricate lobster back bend into shapes **Principles:** The student should explain the principles of: • Developing different types of patterns • Transforming	This unit can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Working drawing • Measuring tape • Try square • Tools box	

		Practical work: Guide the student on how to perform fabrication of lobster back bend **Activity:** Organize the students in manageable group to perform fabrication Perform fabrication of lobster back bend	• Cut, bend and form pipe • Check accuracy of shapes • Clean machines, tools and store safely		drawing measurements to pipe • Taking different measurement and perform calculations • Observe measurement and allowances **Theories:** The student should explain: • Types of pipes and their properties • Types of pipe forming machines - Different types of pipe sizes **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while doing the fabrication of lobster back bend work • Principles of paten development	• Ball peen Hammer • Scriber • Grooving tools • Bending machine • Seaming machine • Gas Cutting plant • Arc welding Equipment • Cutting machine • Angle grinder • Forming tools • Contour mark • center finder • soap chalk • Prick punch • Spirit Level • Clear goggles • Leather apron • Overalls • Leather gloves • Industrial boots • Canvas spats
		(c). Performing fabrication of equal pipe T-piece	**Brainstorm:** Guide the students to define equal pipe T- piece explain how to	**The student should be able to:** • Interpret working drawings • Take correct measurements • Prepare pipe for	Equal pipe T-piece fabricated to form angles as per requirements	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the techniques used to Fabricate equal pipe	This element can be achieved at a work place or training institution. The following tools, equipment,

				fabricate equal pipe T- piece and explain techniques used to fabricate equal pipe T-piece **Practical work:** Guide the student on how to perform fabrication of equal pipe T-piece **Activity:** Organize the students in manageable group to perform fabrication of equal pipe T-piece	fabrication • Calculate allowances using formulae • Develop different types of patterns • Set pipe into a machine • Cut, bend and form pipe • Check accuracy of shapes • Clean machines, tools and store safely		T- piece **Principles:** The student should explain the principles of: • Developing different types of patterns • Transforming drawing measurements to pipe • Taking different measurement and perform calculations • Observe measurement and allowances **Theories:** The student should explain: • Types of pipes and their properties • Types of pipe forming machines • Different types of pipe sizes **Circumstantial knowledge:** **Detailed knowledge about:** Safety precautions to be observed while doing the fabrication equal pipe T- piece work • Principles of paten	and safety gear are to be available • Working drawing • Measuring tape • Try square • Tools box • Ball peen Hammer • Scriber • Grooving tools • Bending machine • Seaming machine • Gas Cutting plant • Arc welding Equipment • Cutting machine • Angle grinder • Forming tools • Contour mark • center finder • soap chalk • Prick punch • Spirit Level • Clear goggles • Leather apron • Overalls • Leather gloves • Industrial boots • Canvas spats

				development	
(d). Performing fabrication of 60º pipe	**Brainstorm:** Guide the students to define 60º pipe explain how to fabricate 60º pipe and explain techniques used to fabricate 60º pipe **Practical work:** Guide the students on how to perform fabrication of 60º pipe **Activity:** Organize the students in manageable groups to perform fabrication of 60º pipe	**The student should be able to:** • Interpret working drawings • Take correct measurements • Prepare pipe for fabrication • Calculate allowances using formulae • Develop different types of patterns • Set pipe into a machine • Cut, bend and form pipe • Check accuracy of shapes • Clean machines, tools and store safely •	60º pipe fabricated to form different angles as per requirements	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the techniques used to Fabricate 60º pipe shapes **Principles:** The student should explain the principles of: • Developing different types of patterns • Transforming drawing measurements to pipe • Taking different measurement and perform calculations • Observe measurement and allowances **Theories:** The student should explain: - Types of pipes and their properties - Types of pipe forming machines - Different types of pipe sizes **Circumstantial knowledge:** **Detailed knowledge**	This unit can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Working drawing • Measuring tape • Try square • Tools box • Ball peen Hammer • Scriber • Grooving tools • Bending machine • Seaming machine • Gas Cutting plant • Arc welding Equipment • Cutting machine • Angle grinder • Forming tools • Contour mark • center finder • soap chalk • Prick punch • Spirit Level

					about: -Safety precautions to be observed while doing the fabrication of 60^{o} pipe work -Principles of paten development	• Clear goggles • Leather apron • Overalls • Leather gloves • Industrial boots • Canvas spats
	(e). Performing fabrication of sweep –tee	**Brainstorm:** Guide the students to define sweep–tee explain how to fabricate sweep–tee and explain techniques used to fabricate sweep–tee **Practical work:** Guide the student on how to perform fabrication of sweep–tee **Activity:** Organize the students in manageable groups to Perform fabrication of sweep–tee	**The student should be able to:** • Interpret working drawings • Take correct measurements • Prepare pipe for sweep –tee fabrication • Calculate allowances using formulae • Develop different types of patterns • Set pipe into a machine • Cut, bend and form pipe • Check accuracy of shapes • Clean machines, tools and store safely	sweep –tee fabricated to form different angles as per requirements	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the techniques used to Fabricate sweep–tee into shapes **Principles:** The student should explain the principles of: • Developing different types of patterns • Transforming drawing measurements to pipe • Taking different measurement and perform calculations • Observe measurement and allowances **Theories:** The student should explain: • Types of pipes and their properties • Types of pipe forming machines	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Working drawing • Measuring tape • Try square • Tools box • Ball peen Hammer • Scriber • Grooving tools • Bending machine • Seaming machine • Gas Cutting plant • Arc welding Equipment • Cutting machine • Angle grinder

						• Different types of pipe sizes **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions to be observed while doing the fabrication of sweep –tee work • Principles of paten development	• Forming tools • Contour mark • center finder • soap chalk • Prick punch • Spirit Level • Clear goggles • Leather apron • Overalls • Leather gloves • Industrial boots • Canvas spats	
	5.3. Carrying out high density poly ethylene pipe welding (HDPE)	(a). Performing electrofusion welding	**Brainstorm:** Guide the students to define electrofusion welding explain how to perform electrofusion welding and explain technique used to perform electrofusion welding **Practical work:** Guide the student on procedure of how to perform electrofusion	**The student should be able to:** • Select butt fusion machine • Selecting of alignment jig • Take correct measurements • Alignment of HDPE pipe • Shaving of pipe surface • Heating of pipe surface • Required temperature of fusion • cooling of the joint • checks of weld seams • Check accuracy of shapes • Clean machines,	HDPE Pipe welded as per requirements	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the techniques used to Weld butt HDPE pipe of different sizes **Principles:** The student should explain the principles of: • Hydraulic system • Parameters required for HDPE welding • Taking different measurement • Setting heat and pressure • Obtaining allowances required for fusion **Theories:** The student should explain: • Types HDPE pipes	This element can be achieved at a work place or training institution. The following tools, equipment and safety gear are to be available • Butt fusion welding machine and accessories • Working drawing • Measuring tape • Try square • Tools box • Power hacksaw machine • Angle grinder • Forming tools	**30**

			welding **Activity:** Organize the students in manageable groups to perform electrofusion welding work	tools and store safely		and their composition • Difference between HDPE pipe and PVC pipe • Methods of butt joining HDPE pipe **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions while dealing with HDPE pipe butt welding • Observation of heating time	• Electro fusion machine • Pipe stand • Marker pen • Steel ruler • Scraper • Hand hacksaw • Spirit Level • Clear goggles • Leather gloves • Overalls • Leather gloves • Industrial boots • Canvas spats	
		(b). Performing butt fusion welding	**Brainstorm:** Guide the students to define electrofusion butt welding explain how to perform electrofusion butt welding and explain techniques used to perform electrofusion butt welding **Practical work:** Guide the student on	**The student should be able to:** • Select butt fusion machine • Selecting of alignment jig • Take correct measurements • Alignment of HDPE pipe • Shaving of pipe surface • Heating of pipe surface • Required temperature of fusion • cooling of the joint • checks of weld seams	HDPE Pipe butt joint welded as per requirements	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the techniques used to Weld HDPE pipe of different sizes **Principles:** The student should explain the principles of: • Hydraulic system • Parameters required for HDPE welding • Taking different measurement • Setting heat and pressure	This unit can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Butt fusion welding machine and accessories • Working drawing • Measuring tape • Try square • Tools box • Power	

			procedure of how to perform electrofusion butt welding **Activity:** Organize the students in manageable groups to perform electrofusion butt welding work	• Check accuracy of shapes • Clean machines, tools and store safely		• Obtaining allowances required for fusion **Theories:** The student should explain: • Types HDPE pipes and their composition • Difference between HDPE pipe and PVC pipe • Methods of joining HDPE pipe **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions while dealing with HDPE pipe butt welding • Observation of heating time	hacksaw machine • Angle grinder • Forming tools • Electro fusion machine • Pipe stand • Marker pen • Steel ruler • Scraper • Hand hacksaw • Spirit Level • Clear goggles • Leather gloves • Overalls • Leather gloves • Industrial boots • Canvas spats	
		(c). Performing saddle fusion welding	**Brainstorm:** Guide the students to define saddle fusion welding explain how to perform saddle fusion welding and explain techniques used to perform	**The student should be able to:** • Select butt fusion machine • Selecting of alignment jig • Take correct measurements • Alignment of HDPE pipe • Shaving of pipe surface • Heating of pipe	HDPE Pipe saddle fusion welded as per requirements	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain the techniques used to saddle fusion welding **Principles:** The student should explain the principles of: • Hydraulic system • Parameters required for HDPE welding	This unit can be achieved at a work place or training institution, The following tools, equipment, and safety gear are to be available • Butt fusion welding machine and	

			saddle fusion welding **Practical work:** Guide the student on procedure of how to perform saddle fusion welding **Activity:** Organize the students in manageable group to perform saddle fusion welding work	surface • Required temperature of fusion • cooling of the joint • checks of weld seams • Check accuracy of shapes • Clean machines, tools and store safely		• Taking different measurement • Setting heat and pressure • Obtaining allowances required for fusion **Theories:** The student should explain: • Types HDPE pipes and their composition • Difference between HDPE pipe and PVC pipe • Methods of joining HDPE pipe **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions while dealing with saddle fusion welding - Observation of heating time	accessories • Working drawing • Measuring tape • Try square • Tools box • Power hacksaw machine • Angle grinder • Forming tools • Electro fusion machine • Pipe stand • Marker pen • Steel ruler • Scraper • Hand hacksaw • Spirit Level • Clear goggles • Leather gloves • Overalls • Leather gloves • Industrial boots • Canvas spats	
6. Performing welding testing and inspection of steels	6.1. Carrying out destructive testing.	(a). Performing bend test	**Brainstorm:** Guide the students to define destructive testing explain how to perform bend test	**The student should be able to:** • Check welding procedures • Check quality and condition of base and filler materials to be used • Check weld preparation	The welded metal, tested and inspected as per Technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain: • Visual inspection procedures and techniques • Types of	The following tools, equipment, and safety gear are to be available • Pressing Machine • Tensile Test Machine • Sledge	**50**

			and explain techniques used to perform bend test **Practical work:** Guide the student on procedure of how to perform bend test **Activity:** Organize the students in manageable groups to perform bend test on the welded work	• Check quality of individual weld appearance • Check back gouged surface • Check finished weld appearance • Check weld size • Check dimensional accuracy of weldment • Observe safety • • Observe weld defects • Checks weld size • Clean and store tools • Clean and store tools • Prepare inspection report		Destructive test tools • destructive examine procedures and techniques • Types of destructive inspection devices **Principles:** The student should explain the principles of: • Destructive test • Using of Destructive test tools and equipment • Selecting of inspection process • Destructive testing • Using of destructive inspection devices • Selecting of inspection process • Producing inspection report • Producing inspection report **Theories:** The student should explain: • The main purpose of Destructive test • The applications of inspection tools and equipment • The main purpose of destructive examine • The applications of Destructive test equipment	Hammer • Vanier caliper • Weld gauges • Bevel gauge • Bridge cam gauges • Fillet Weld gauge • Temperature indicator • Hi–lo gauge • Magnifying lance • Magnetic tester • Tape measure • Micrometer screw gauge • Folding steel rule • Safety boots • Welding shield • Leather gloves • Leather apron	

						Circumstantial knowledge: **Detailed knowledge about:** - Safety precautions to be considered when performing bend test - First Aid		
		(b). Performing tensile test	**Brainstorm:** Guide the students to define destructive testing explain how to perform tensile test and explain techniques used to perform tensile test **Practical work:** Guide the student on procedure of how to perform tensile test **Activity:** Organize the students in manageable groups to perform tensile	**The student should be able to:** • Check welding procedures • Check quality and condition of base and filler materials to be used • Check weld preparation • Check quality of individual weld appearance • Check back gouged surface • Check finished weld appearance • Check weld size • Check dimensional accuracy of weldment • Observe safety • Apply penetrant medium • Insert inspection device	The welded metal, tested and inspected as per Technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain: • Visual inspection procedures and techniques • Types of Destructive test tools • destructive examine procedures and techniques • Types of destructive inspection devices **Principles:** The student should explain the principles of: - Destructive test • Using of Destructive test tools and equipment • Selecting of	The following tools, equipment, and safety gear are to be available • Pressing Machine • Tensile Test Machine • Sledge Hammer • Vanier caliper • Weld gauges • Bevel gauge • Bridge cam gauges • Fillet Weld gauge • Temperature indicator • Hi – lo gauge • Magnifying lance • Magnetic tester • Tape measure • Micrometer	

			test on the welded work	• Observe weld defects • Checks weld size • Clean and store tools • Clean and store tools • Prepare inspection report		inspection process • Selecting of inspection process • Producing inspection report **Theories:** The student should explain: • The main purpose of Destructive test • The applications of inspection tools and equipment • The applications of Destructive test equipment **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be considered when performing tensile test First Aid	screw gauge • Folding steel rule • Safety boots • Welding shield • Leather gloves • Leather apron	
		(c). Performing impact test	**Brainstorm:** Guide the students to define destructive testing explain how to perform impact test and explain	**The student should be able to:** • Check welding procedures • Check quality and condition of base and filler materials to be used • Check weld	The welded metal, tested and inspected as per Technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain: • Types of Destructive test tools	The following tools, equipment, and safety gear are to be available • Pressing Machine • Tensile Test Machine	

			technique used to perform impact test **Practical work:** Guide the student on procedure of how to perform impact test **Activity:** Organize the students in manageable group to perform impact test on the welded work	preparation • Check quality of individual weld appearance • Check finished weld appearance • Check weld size • Check dimensional accuracy of weldment • Observe safety • Apply penetrant medium • Insert inspection device • Observe weld defects • Checks weld size • Clean and store tools • Clean and store tools • Prepare inspection report		• impact test procedures and techniques • Types of impact test inspection devices **Principles:** The student should explain the principles of: • impact test • Using of impact test tools and equipment • Using of impact test inspection devices • Producing inspection report **Theories:** The student should explain: • The main purpose of impact test • The applications of inspection tools and equipment **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be considered when performing impact test - First Aid	• Sledge Hammer • Vanier caliper • Weld gauges • Bevel gauge • Bridge cam gauges • Fillet Weld gauge • Temperature indicator • Hi – lo gauge • Magnifying lance • Magnetic tester • Tape measure • Micrometer screw gauge • Folding steel rule • Safety boots • Welding shield • Leather gloves • Leather apron	
	6.2. Carrying out non–destructive testing.	(a). Performing visual inspection. (VI)	**Brainstorm:** Guide the students to define non – destructive testing	**The student should be able to:** • Check welding procedures • Check quality and condition of	The welded metal, tested and inspected as per Technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain:	The following tools, equipment, and safety gear are to be available • Vanier caliper	**40**

			Explain how to perform visual inspection (VI) and explain technique used to perform visual inspection (VI) **Practical work:** Guide the students on procedure of how to perform visual inspection (VI) **Activity:** Organize the students in manageable groups to perform visual inspection (VI) on the welded work	base and filler materials to be used • Check weld preparation • Check quality of individual weld appearance • Check finished weld appearance • Check weld size • Check dimensional accuracy of weldment • Observe safety • Apply penetrant medium • Insert inspection device • Observe weld defects • Checks weld size • Clean and store tools • Clean and store tools • Prepare inspection report		• Visual inspection procedures and techniques • Types of visual inspection tools • Non-destructive examine procedures and techniques • Types of non - destructive inspection devices **Principles:** The student should explain the principles of: - Visual inspection • Using of visual inspection tools and equipment • Non – destructive testing • Using of non-destructive inspection devices • Selecting of inspection process • Producing inspection report • Producing inspection report **Theories:** The student should explain: • The main purpose of visual inspection • The applications of inspection tools and equipment • The main purpose of	• Ultrasonic thickness gauge • Magnetic inspection yoke • Digital pyrometer • Weld gauges • Bevel gauge • Bridge cam gauges • Fillet Weld gauge • Temperature indicator • Hi – lo gauge • Magnifying lance • Magnetic tester • Magnetic metal spray • Dye penetrant • Tape measure • Micrometer screw gauge • Folding steel rule • Safety boots • Welding shield • Leather gloves • Leather apron	

						non – destructive examine • The applications of inspection equipment **Circumstantial knowledge:** **Detailed knowledge about:** Safety precautions to be considered when performing visual inspection (VI) - First Aid		
		(b). Performing magnetic particle inspection (MPI)	**Brainstorm:** Guide the students to define non – destructive testing Explain how to perform magnetic particle inspection (MPI) and explain technique used to perform magnetic particle inspection (MPI) **Practical work:** Guide the student on procedure of how to perform	**The student should be able to:** • Check welding procedures • Check quality and condition of base and filler materials to be used • Check weld preparation • Check quality of individual weld appearance • Check finished weld appearance • Check weld size • Check dimensional accuracy of weldment • Observe safety • Apply penetrant medium • Insert inspection	The welded metal, tested and inspected as per Technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain: • Visual inspection procedures and techniques • Types of magnetic particle inspection (MPI) tools • magnetic particle inspection (MPI) procedures and techniques • **Principles:** The student should explain the principles of: • magnetic particle inspection (MPI) • Using of magnetic	The following tools, equipment, and safety gear are to be available • Vanier caliper • Ultrasonic thickness gauge • Magnetic inspection yoke • Digital pyrometer • Weld gauges • Bevel gauge • Bridge cam gauges • Fillet Weld gauge • Temperature indicator • Hi – lo gauge	

			magnetic particle inspection (MPI) **Activity:** Organize the students in manageable groups to perform magnetic particle inspection (MPI) on the welded work	• device • Observe weld defects • Checks weld size • Clean and store tools • Clean and store tools • Prepare inspection report		• particle inspection (MPI) tools and equipment • magnetic particle inspection (MPI) • Producing inspection report • Producing inspection report **Theories:** The student should explain: • The main purpose of magnetic particle inspection (MPI) • The applications of inspection tools and equipment • The applications of inspection equipment **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be considered when performing magnetic particle inspection (MPI) - First Aid	• Magnifying lance • Magnetic tester • Magnetic metal spray • Dye penetrant • Tape measure • Micrometer screw gauge • Folding steel rule • Safety boots • Welding shield • Leather gloves • Leather apron
		(c). Performing die penetrant inspection(DP)	**Brainstorm:** Guide the students to define non – destructive testing Explain how to	**The student should be able to:** • Check welding procedures • Check quality and condition of base and filler	The welded metal, tested and inspected as per Technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain: • die penetrant	The following tools, equipment, and safety gear are to be available • Vanier caliper • Ultrasonic

				perform die penetrant inspection(DP)and explain technique used to perform die penetrant inspection(DP) **Practical work:** Guide the students on procedure of how to perform die penetrant inspection(DP) **Activity:** Organize the students in manageable groups to Perform die penetrant inspection(DP) on the welded work	materials to be used • Check weld preparation • Check quality of individual weld appearance • Check back gouged surface • Check finished weld appearance • Check weld size • Check dimensional accuracy of weldment • Observe safety • Apply penetrant medium • Insert inspection device • Observe weld defects • Checks weld size • Clean and store tools • Clean and store tools • Prepare inspection report		inspection(DP) procedures and techniques • Types of die penetrant inspection(DP) • Types of non - destructive inspection devices **Principles:** The student should explain the principles of: - die penetrant inspection(DP) - die penetrant inspection(DP) - Using of die penetrant inspection(DP) - Producing inspection report **Theories:** The student should explain: - The main purpose of die penetrant inspection(DP) - The applications of inspection tools and equipment - The applications of inspection equipment **Circumstantial knowledge:** **Detailed knowledge about:**	thickness gauge • Magnetic inspection yoke • Digital pyrometer • Weld gauges • Bevel gauge • Bridge cam gauges • Fillet Weld gauge • Temperature indicator • Hi – lo gauge • Magnifying lance • Magnetic tester • Magnetic metal spray • Dye penetrant • Tape measure • Micrometer screw gauge • Folding steel rule • Safety boots • Welding shield • Leather gloves • Leather apron

					- Safety precautions to be considered when performing die penetrant inspection(DP) - First Aid	
	(d). Performing ultrasonic testing (UT)	**Brainstorm:** Guide the students to define non – destructive testing Explain how to perform ultrasonic testing (UT)and explain techniques used to perform ultrasonic testing (UT) **Practical work:** Guide the students on procedure of how to perform ultrasonic testing (UT) **Activity:** Organize the students in manageable groups to Perform ultrasonic testing (UT)	**The student should be able to:** • Check welding procedures • Check quality and condition of base and filler materials to be used • Check weld preparation • Check quality of individual weld appearance • Check back gouged surface • Check finished weld appearance • Check weld size • Check dimensional accuracy of weldment • Observe safety • Apply penetrant medium • Insert inspection device • Observe weld defects • Checks weld size	The welded metal, tested and inspected as per Technical specifications	**Knowledge Evidence Detailed knowledge of:** **Method used:** The student should explain: • ultrasonic testing (UT) procedures and techniques • Types of ultrasonic testing (UT) tools • **Principles:** The student should explain the principles of: - ultrasonic testing (UT) - Using of ultrasonic testing (UT) tools and equipment - Producing ultrasonic testing (UT) report - Producing inspection report **Theories:** The student should explain: - The main purpose of ultrasonic testing (UT)	The following tools, equipment, and safety gear are to be available • Vanier caliper • Ultrasonic thickness gauge • Magnetic inspection yoke • Digital pyrometer • Weld gauges • Bevel gauge • Bridge cam gauges • Fillet Weld gauge • Temperature indicator • Hi – lo gauge • Magnifying lance • Magnetic tester • Magnetic metal spray • Dye

			on the welded work	• Clean and store tools • Clean and store tools • Prepare inspection report		- The applications of ultrasonic testing (UT) tools and equipment **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be considered when performing ultrasonic testing (UT) - First Aid	penetrant • Tape measure • Micrometer screw gauge • Folding steel rule • Safety boots • Welding shield • Leather gloves • Leather apron	
		(e). Performing eddy current test (ET)	**Brainstorm:** Guide the students to define non–destructive testing Explain how to perform eddy current test (ET) and explain technique used to perform eddy current test (ET) **Practical work:** Guide the student on procedure of how to perform eddy current test (ET) **Activity:** Organize the students in	**The student should be able to:** • Check welding procedures • Check quality and condition of base and filler materials to be used • Check weld preparation • Check quality of individual weld appearance • Check back gouged surface • Check finished weld appearance • Check weld size • Check dimensional accuracy of weldment	The welded metal, tested and inspected as per Technical specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain: • eddy current test (ET) procedures and techniques • Types of eddy current test (ET) tools • Types of eddy current test (ET) inspection devices **Principles:** The student should explain the principles of: - eddy current test (ET) - Using of eddy current test (ET) tools and	The following tools, equipment, and safety gear are to be available • Vanier caliper • Ultrasonic thickness gauge • Magnetic inspection yoke • Digital pyrometer • Weld gauges • Bevel gauge • Bridge cam gauges • Fillet Weld gauge • Temperature	

			manageable groups to perform eddy current test (ET) on the welded work	• Observe safety • Insert inspection device • Observe weld defects • Checks weld size • Clean and store tools • Clean and store tools • Prepare inspection report		equipment - Producing eddy current test (ET) report **Theories:** The student should explain: - The main purpose of eddy current test (ET) - The applications of eddy current test (ET) tools and equipment - The applications of eddy current test (ET) equipment **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions to be considered when performing eddy current test (ET) - First Aid	indicator • Hi – lo gauge • Magnifying lance • Magnetic tester • Magnetic metal spray • Dye penetrant • Tape measure • Micrometer screw gauge • Folding steel rule • Safety boots • Welding shield • Leather gloves • Leather apron	
7. Performing planning and managerial duties for preventive maintenance	7.1. Carrying out planning and report writing	(a). Preparing maintenance schedule	**Brainstorm:** Guide the students to define maintenance schedule Explain how to prepare maintenance schedule and explain techniques used	**The student should be able to:** • Identify maintenance activities • Select resources • Prepare maintenance schedule • Write report	A maintenance schedule prepared conforms to technical specifications	**Knowledge Evidence** **Detailed knowledge of:** • **Method used:** The student should explain how to • Prepare workshop/workplace inspection report • Prepare	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Papers • Manila	**30**

			to Prepare maintenance schedule **Practical work:** Guide the student on procedure of how to plan and prepare maintenance schedule **Activity:** Organize the students in manageable groups to plan and prepare maintenance schedule Of the welding work shop machines			workshop/workplace color code and safety signs • Plan and prepare workshop inventory • Plan and prepare preventive maintenance training **Principles:** The student should explain the principles of: • Planning • Organizing • Writing report on preventive maintenance **Theories:** The student should explain: - Importance of interpreting service manuals - Importance of preparing maintenance schedule - Importance of preparing maintenance training programmes **Circumstantial knowledge:** **Detailed knowledge about:** - Safety precautions while	sheets • Erasers • Pencils • Mark pens • Pens • Ruler • Safety requirement • Bin card /check list • Computer • Printer	

						planning preventive maintenance - Waste disposal procedures		
		(b). Preparing inspection check list	**Brainstorm:** Guide the students to define inspection check list Explain how to prepare inspection check list and explain techniques used to Prepare inspection check list **Practical work:** Guide the student on procedure of how to plan and prepare inspection check list **Activity:** Organize the students in manageable groups to plan and prepare inspection check list Of the welding work shop	**The student should be able to:** • Identify maintenance activities • Prepare inspection check list • Write report	A inspection check list Prepared conforms to technical specifications	**Knowledge Evidence Detailed knowledge of:** • **Method used:** The student should explain how to • Prepare workshop/workplace inspection check list • Plan and prepare check list **Principles:** The student should explain the principles of: • Writing check list of preventive maintenance **Theories:** The student should explain: - Importance of interpreting service manuals - Importance of preparing check list **Circumstantial knowledge: Detailed knowledge about:** - Safety precautions while planning	This unit can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Papers • Manila sheets • Erasers • Pencils • Mark pens • Pens • Ruler • Safety requirement • Bin card /check list • Computer • Printer	

			machines			preventive maintenance - Safe handling of tools and equipment - Waste disposal procedures		
		(c). Preparing maintenance report	**Brainstorm:** Guide the students to define maintenance report Explain how to prepare maintenance report and explain techniques used to prepare maintenance report **Practical work:** Guide the student on procedure of how to prepare maintenance report **Activity:** Organize the students in manageable groups to prepare maintenance report	**The student should be able to:** • Identify maintenance activities • Select resources • Prepare inspection check list • Prepare maintenance schedule • Write report	A maintenance report wrote conforms to technical specifications	**Knowledge Evidence Detailed knowledge of:** • **Method used:** The student should explain how to • Prepare workshop/workplace maintenance report • **Principles:** The student should explain the principles of: • Writing report on preventive maintenance **Theories:** The student should explain: - Importance of interpreting service manuals - Importance of preparing workshop inspection reports and maintenance schedule **Circumstantial knowledge:**	This unit can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Papers • Manila sheets • Erasers • Pencils • Mark pens • Pens • Ruler • Safety requirement • Bin card /check list • Computer • Printer	

			of the welding work shop machines			**Detailed knowledge about:** - Safety precautions while planning preventive maintenance - Safe handling of tools and equipment - Waste disposal procedures		
	7.2. Controlling and manage workshop tools and equipment	(a) Preparing and manage inventory	**Brainstorm:** Guide the students to define work shop inventory Explain how to prepare and manage inventory explain techniques used to Prepare and manage inventory **Practical work:** Guide the student on procedure of how to prepare and manage inventory **Activity:** Organize the students in manageable	**The student should be able to:** • Prepare inform action in the inventory list • Identify source of information in inventory list • Mark the equipment • Prepare facility register • Identify proper manuals • Interpreted manual • Carry out physical inspection of machine/equipment • Use information to prepare maintenance schedule	A controlled and managed workshop tools and equipment conforms technical specification	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain how to prepare inventory and work schedule for preventive maintenance **Principles:** The student should explain the principles of: • Inventory checking • Preventive maintenance work schedule **Theories:** The student should explain: - Information in the inventory list - Sources of information on the inventory list **Circumstantial**	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Store ledger • Inventory record book • Pen • Papers • Bin card • Ruler • Pencil • Eraser • Manila sheet • Marker pen • Safety boots • Safety goggles • Collection fluid	**25**

		groups to prepare and manage inventory Of the welding work shop			**knowledge:** **Detailed knowledge about:** - Observe Safety precautions - First Aid		
	(b). Preparing preventive maintenance work schedule	**Brainstorm:** Guide the students to define maintenance schedule Explain how to prepare maintenance schedule and explain technique used to prepare maintenance schedule **Practical work:** Guide the student on procedure of how to plan and prepare maintenance schedule **Activity:** Organize the students in manageable groups to plan and prepare maintenance	**The student should be able to:** • Prepare inform action in the inventory list • Identify source of information in inventory list • Mark the equipment • Prepare facility register • Identify proper manuals • Interpreted manual • Carry out physical inspection of machine/equipment • Use information to prepare maintenance schedule	A Prepare preventive maintenance work schedule workshop tools and equipment conforms technical specification	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain how to prepare inventory and work schedule for preventive maintenance **Principles:** The student should explain the principles of: • Inventory checking • Preventive maintenance work schedule **Theories:** The student should explain: - Information in the inventory list - Sources of information on the inventory list **Circumstantial knowledge:** **Detailed knowledge about:** - Observe Safety precautions	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Store ledger • Inventory record book • Pen • Papers • Bin card • Ruler • Pencil • Eraser • Manila sheet • Marker pen • Safety boots • Safety goggles • Collection fluid	

			schedule Of the welding work shop machines			- First Aid		
	7.3. Controlling budget and production activities	(a) Preparing budget for maintenance	**Brainstorm:** Guide the students to define maintenance schedule Explain how to prepare budget for maintenance and explain technique used to prepare budget for maintenance **Practical work:** Guide the student on procedure of how to plan and prepare budget for maintenance **Activity:** Organize the students in manageable groups to plan and Prepare budget for maintenance of the welding work shop	**The student should be able to:** • Calculate manpower cost • Material spear pats cost • Machine cost • Contracting cost • Overhead cost	Controlled budget conform budget specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain: • The budget for preventive maintenance • The production costs **Principles:** The student should explain the principles of how to prepare the budget for maintenance **Theories:** The student should explain: - Importance of preventive maintenance budget and production costs - Basic factors in preparation of maintenance budget and production **Circumstantial knowledge:** **Detailed knowledge about:** - Observe Safety	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Set of computer • Price check list • Pens • Paper (4 paper) • Correction ink • Plastic rule • Calculator • Chalk • Pencil • Eraser	**20**

						precautions when prepare budget and production activities - Observing over cost		
		(b). Preparing production costs	**Brainstorm:** Guide the students to define cost costing and production costs Explain how to prepare production costs and explain technique used to prepare budget for maintenance **Practical work:** Guide the students on procedure of how to plan and prepare production costs **Activity:** Organize the students in manageable group to plan and Prepare production costs Of the welding work shop	**The student should be able to:** • Calculate manpower cost • Material spear pats cost • Machine cost • Contracting cost • Overhead cost	Controlled production costs conform budget specifications	**Knowledge Evidence** **Detailed knowledge of:** **Method used:** The student should explain: • The production costs **Principles:** The student should explain the principles of how to prepare the production costs **Theories:** The student should explain: - Importance of production costs - Basic factors in preparation of production cost **Circumstantial knowledge:** **Detailed knowledge about:** - Observe Safety precautions when prepare production costs activities - Observing over cost	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gear are to be available • Set of computer • Price check list • Pens • Paper (4 paper) • Correction ink • Plastic rule • Calculator • Chalk • Pencil • Eraser	

8. Managing fabrication workshop activities	8.1. Designing workshop layout	(a). Layingout workshop service area	**Brainstorm:** Guide the students to define workshop layout Explain how to layout workshop service area and explain techniques used to Layout workshop service area **Practical work:** Guide the student on procedure/ steps to design workshop layout **Activity:** Organize the students in manageable groups to plan and design workshop layout of the welding work shop	**The student should be able to:** • Select tools and equipment • Plan workshop layout • Locate different workshop sections • Locate the installation of different machines • Identify places for safety gears equipment • Identify convenient place for stores • Identify convenient place to assemble in case of emergency • Mark emergency exit • Locate information resource center • Locate laundry and latrines • Design security system of tools and equipment • Design safety	Designed workshop layout conforms to environmental regulations and ministry of labor rules and regulations	**Knowledge evidence: Detailed knowledge of:** **Method used:** The student should explain how to arrange different workshop sections **Principles:** The student should explain the principles of: • Laying out workshop • Machine installation in workshop **Theories:** The student should explain: • Steps to design workshop layout **Circumstantial knowledge Detailed knowledge about:** • Safety handling of working tools and equipment • Waste disposal	This unit can be achieved at the work place or training institution. The following tools, safety gears, and equipment should be available: • Organizatio n structures • Workshop building map • Different workshop layouts • Overhead projector • Computer with power point • Flip charts • Chalk board • Workshop with various sections • Measuring tools • Highlight mark • Drawing instruments	**4**

				system to workers • Identify marks and postures • Place sign mark and postures • Label safety precautions for workshop materials and goods			• Handouts • Stationeries • Drawing instruments	
		(b). Laying out workshop machine	**Brainstorm:** Guide the students to define workshop machine layout Explain how to layout workshop service area and explain techniques used to workshop machine layout area **Practical work:** Guide the student on procedure/ steps to design workshop machine layout **Activity:** Organize the students in manageable group to plan and design workshop	**The student should be able to:** • Select tools and equipment • Plan workshop layout • Locate different workshop sections • Locate the installation of different machines • Identify places for safety gears equipment • Identify convenient place for stores • Identify convenient place to assemble in case of emergency • Mark emergency exit • Locate	Designed workshop machine layout conforms to environmental regulations and ministry of labour rules and regulations	**Knowledge evidence: Detailed knowledge of:** **Method used:** The student should explain how to arrange different workshop sections **Principles:** The student should explain the principles of: • Laying out workshop Machine installation **Theories:** The student should explain: • Steps to design workshop machine layout • Components applied in workshop machine safety and security systems	This element can be achieved at the work place or training institution. The following tools, safety gears, and equipment should be available: • Organizatio n structures • Workshop building map • Different workshop layouts • Overhead projector • Computer with power point • Flip charts • Chalk board • Workshop	

			machine layout of the welding work shop	information resource center • Locate laundry and latrines • Design security system of tools and equipment • Design safety system to workers • Identify marks and postures • Place sign mark and postures • Label safety precautions for workshop materials and goods		**Circumstantial knowledge** **Detailed knowledge about:** • Safety handling of working tools and equipment • Waste disposal	with various sections • Measuring tools • Highlight mark • Drawing instruments • Handouts • Stationeries • Drawing instruments	
		(c). Laying out machine storage area.	**Brainstorm:** Guide the students to define workshop machine storage layout Explain how to layout workshop machine storage service area and explain techniques used to workshop machine storage layout area **Practical work:** Guide student on procedure/ steps to design	**The student should be able to:** • Select tools and equipment • Plan workshop layout • Locate the installation of different machines • Identify places for safety gears equipment • Identify convenient place for stores • Identify convenient place to assemble in	Designed machine storage layout conforms to environmental regulations and ministry of labour rules and regulations	**Knowledge evidence:** **Detailed knowledge of:** **Method used:** The student should explain how to arrange different workshop sections **Principles:** The student should explain the principles of: • Laying out workshop Machine storage **Theories:** The student should explain: • Steps to design workshop	This unit can be achieved at the work place or training institution. The following tools, safety gears, and equipment should be available: • Organizatio n structures • Workshop building map • Different workshop layouts	

			workshop machine storage layout **Activity:** Organize the students in manageable group to plan and design workshop machine storage layout of the welding work shop	case of emergency • Mark emergency exit • Locate information resource center • Design security system of tools and equipment • Design safety system to workers • Identify marks and postures • Place sign mark and postures • Label safety precautions for workshop materials and goods		machine storage layout **Circumstantial knowledge** **Detailed knowledge about:** • Safety handling of working tools and equipment • Waste disposal	• Overhead projector • Computer with power point • Flip charts • Chalk board • Workshop with various sections • Measuring tools • Highlight mark • Drawing instruments • Handouts • Stationeries • Drawing instruments	
	8.2. Controlling tools and equipment movement	(a). Maintaining tools control system.	**Brainstorm:** Guide students to define tools and equipment Explain how to maintain tools control system and explain technique used to maintain tools control system **Practical work:** Guide student on procedure/ Steps to	**The student should be able to:** • Select tools and equipment • Design tools storage system • Keep record of tools and equipment in workshop • Record tools and equipment issued daily from stores • Record tools and equipment	Tools and equipment controlled as per Public Procurement Regulatory Act (PPRA) guidelines	**Knowledge evidence:** **Detailed knowledge of:** **Method used:** The student should explain how to: • Maintain tools ledgers • Maintain Tools inventory records **Principles:** The student should explain the principles of controlling tools and equipment in the	This element can be achieved at a work place or in a training institution. The following tools, equipment, and safety gears should be available: • Logbook • Tools and equipment catalogue • Stationeries • Scientific	**4**

		maintain tools control system **Activity:** Organize the students in manageable groups to plan and maintain tools control system of the welding work shop	received daily from user • Record damaged tools and equipment • Record lost equipment and tools • Discard damaged tools and equipment • Order new tools and equipment		workshop **Theories:** The student should explain: • Properties of tools and equipment • Effects of weather on different tools • Necessary security on stores/workshops • Public Procurement Regulatory Act guidelines **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions while controlling tools and equipment • Safe handling of tools and equipment • Waste disposal	calculator • Staple machine • Binding machine • Tools list • Wall robe • Bench with tool Crip • Toolboxes • Tools issue voucher • Tools ledger • Equipment ledger • Tools inventory list • Files • Overcoat • Safety boots	
	(b). Taking inventory of tools and equipment	**Brainstorm:** Guide the students to define inventory of tools and equipment Explain how to take inventory of tools and equipment and	**The student should be able to:** • Select tools and equipment • Design tools storage system • Keep record of tools and equipment in workshop	Tools and equipment controlled as per Public Procurement Regulatory Act (PPRA) guidelines	**Knowledge evidence:** **Detailed knowledge of:** **Method used:** The student should explain how to: • Maintain tools ledgers • Maintain Tools inventory records	This element can be achieved at a work place or in a training institution The following tools, equipment, and safety gears should be available:	

			explain technique used to take inventory of tools and equipment **Practical work:** Guide the student on procedure/ Steps to take inventory of tools and equipment **Activity:** Organize the students in manageable groups to perform inventory of tools and equipment of the welding work shop	• Record tools and equipment issued daily from stores • Record tools and equipment received daily from user • Record damaged tools and equipment • Record lost equipment and tools • Discard damaged tools and equipment • Order new tools and equipment		**Principles:** The student should explain the principles of controlling tools and equipment in the workshop **Theories:** The student should explain: • Properties of tools and equipment • Effects of weather on different tools • Necessary security on stores/workshops • Public Procurement Regulatory Act guidelines **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions while controlling tools and equipment • Safe handling of tools and equipment • Waste disposal	• Logbook • Tools and equipment catalogue • Stationeries • Scientific calculator • Staple machine • Binding machine • Tools list • Wall robe • Bench with tool Crip • Toolboxes • Tools issue voucher • Tools ledger • Equipment ledger • Tools inventory list • Files • Overcoat • Safety boots	
	8.3. Estimating materials and labor cost	(a). Maintaining records of workshop materials	**Brainstorm:** Guide the students to define records of	**The student should be able to:** • Select tools and equipment	Performed job costing prepared as per task performed	**Knowledge evidence:** **Detailed knowledge of:** **Method used:** The	This element can be achieved at a work place or in a training	**6**

			workshop materials Explain how to take records of workshop materials and explain technique used to take records of workshop materials **Practical work:** Guide the student on procedure/ Steps to take records of workshop materials **Activity:** Organize the students in manageable groups to perform recording of workshop materials of the welding work shop	• Read inspection report • Prepare material cost estimates • Prepare overhead costs • Prepare material request • Prepare quotations and distribute into various shops • Obtain preform invoice from different shops • Prepare job costing including other overheads		student should explain how to calculate the costs of materials and labour **Principles:** The student should explain the principles of: Maintaining records of workshop materials **Theories:** The student should explain: • Importance of Maintaining records of workshop materials • Importance of using genuine materials • Use of parts catalogue **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions while performing records of workshop materials • Safe handling of materials and documents	institution The following tools, equipment and safety gears should be available: • List of spares parts • Materials list • Local purchasing order (LPO) • Calculator/Computer • Stationeries • Binding machine • Material requisition form or (Material requisition voucher (MRV) • Job card • Price list • Good received note (GRN) • Gloves • Overcoat • Safety boot • Mask	

		(b). Maintaining man hours /day of workshop staff	**Brainstorm:** Guide the students to define man hours /day of workshop staff Explain how to maintain man hours /day of workshop staff and explain technique used to maintain man hours /day of workshop staff **Practical work:** Guide the student on procedure/ Steps to maintain man hours /day of workshop staff **Activity:** Organize the students in manageable groups to perform /maintain man hours /day of workshop staff of the welding work shop	**The student should be able to:** • Select tools and equipment • Read inspection report • Prepare material cost estimates • Prepare overhead costs • Prepare material request • Prepare quotations and distribute into various shops • Obtain proforma invoice from different shops • Prepare job costing including other overheads	Man hours /day of workshop staff Prepared as per task performed	**Knowledge evidence:** **Detailed knowledge of:** **Method used:** The student should explain how to calculate the costs of materials and labour **Principles:** The student should explain the principles of: • Determining man hour rate to make job costing estimates • Calculating cost of materials and labour **Theories:** The student should explain: • Importance of estimating materials and labour cost • Importance of using genuine materials • Use of parts catalogue **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions while performing job	This element can be achieved at a work place or in a training institution The following tools, equipment and safety gears should be available: • List of spares parts • Materials list • Local purchasing order (LPO) • Calculator/Computer • Stationeries • Binding machine • Material requisition form or (Material requisition voucher (MRV) • Job card • Price list • Good received note (GRN) • Gloves • Overcoat • Safety boot • Mask

						costing • Safe handling of materials and documents • Waste disposal	
		(c). Performing job cost calculations	**Brainstorm:** Guide the students to define job cost calculations Explain how to perform job cost calculations and explain technique used to perform job cost calculations **Practical work:** Guide the student on procedure/ steps to perform job cost calculations **Activity:** Organize the students in manageable group to perform job cost calculations of the welding work shop	**The student should be able to:** • Select tools and equipment • Read inspection report • Prepare material cost estimates • Prepare overhead costs • Prepare material request • Prepare quotations and distribute into various shops • Obtain proforma invoice from different shops • Prepare job costing including other overheads	Performed job costing prepared as per task performed	**Knowledge evidence:** **Detailed knowledge of:** **Method used:** The student should explain how to calculate the costs of materials and labour **Principles:** The student should explain the principles of: • Determining man hour rate to make job costing estimates • Calculating cost of materials and labour **Theories:** The student should explain: • Importance of estimating materials and labour cost • Importance of using genuine materials • Use of parts catalogue	This element can be achieved at a work place or in a training institution The following tools, equipment and safety gears should be available: • List of spares parts • Materials list • Local purchasing order (LPO) • Calculator/Computer • Stationeries • Binding machine • Material requisition form or (Material requisition voucher (MRV) • Job card • Price list • Good received	

						Circumstantial knowledge: **Detailed knowledge about:** • Safety precautions while performing job costing • Safe handling of materials and documents • Waste disposal	note (GRN) • Gloves • Overcoat • Safety boot • Mask	
	8.4 Train sub ordinates	(a). Preparing training needs	**Brainstorm:** Guide the students to define training needs Explain how to prepare training needs and explain techniques used to prepare training needs **Practical work:** Guide the student on procedure/ Steps to Prepare training needs **Activity:** Organize the students in	**The student should be able to:** • Select tools and equipment • Prepare capability chart of the subordinates • Conduct training needs assessment • Identify knowledge and skills to be imparted • Identify previous knowledge and skills possessed by the person to be trained • Prepare a training programme for the subordinate • Carryout the	• A training program prepared to meet job requirements • A person trained is able to execute tasks to required standards according to regulations	**Knowledge evidence:** **Detailed knowledge of:** **Method used:** The student should explain how to prepare training programme **Principles:** The student should explain the principles of carrying out training programme by using the four steps (plan, prepare, present, try-out assign work) **Theories:** The student should explain: • Necessity of identifying previous knowledge and skill of the person to be trained • The importance of step by step	This unit can be achieved at a work place or in a training institution The following tools, equipment, and safety gears should be available: • Workshop • Tool box • Tools • Multimeter • Workshop machines i e - Grinding machine - Drilling machine - Valve grinder - Drum and disc service machine	**14**

		manageable groups to Prepare training needs of the welding workers	training programs by using four steps plan (prepare, present, try-out, assign work) • Continually assess progress of workers • Make necessary adjustments to the training programme schedule • Clean the work area • Store tools, equipment, safety gears and other items		guidance from simple to complex tasks **Circumstantial knowledge:** **Detailed knowledge** basic principles of educational psychology	- Wheel balancing machine - Wheel alignment machine/gauge - Head light aiming machine - Testing benches - Bench vices - Anvil - Hydraulic press • Surface block • First aid kit • Firefighting equipment • Emergency exit • Overhead projector • Computer • TV • Organization structure • Safety gears	
	(b). Carrying out training of subordinates	**Brainstorm:** Guide the students to define training needs Explain how to	**The student should be able to:** • Select tools and equipment • Prepare capability chart of the	• A training program prepared to meet job requirements	**Knowledge evidence:** **Detailed knowledge of:** **Method used:** The student should explain how to prepare training programme	This unit can be achieved at a work place or in a training institution. The following tools, equipment,	

			prepare training programme and explain techniques used to prepare training programme **Practical work:** Guide the student on procedure/ pteps to prepare training programme **Activity:** Organize the students in manageable groups to prepare training programme of the welding workers	subordinates • Conduct training needs assessment • Identify knowledge and skills to be imparted • Identify previous knowledge and skills possessed by the person to be trained • Prepare a training programme for the subordinate • Carryout the training programs by using four steps plan (prepare, present, try-out, assign work) • Continually assess progress of workers • Make necessary adjustments to the training programme schedule • Clean the work area • Store tools, equipment, safety gears and other items	• A person trained is able to execute tasks to required standards according to regulations	**Principles:** The student should explain the principles of carrying out training programme by using the four steps (plan, prepare, present, try-out assign work) **Theories:** The student should explain: • Necessity of identifying previous knowledge and skill of the person to be trained • The importance of step by step guidance from simple to complex tasks **Circumstantial knowledge:** **Detailed knowledge** basic principles of educational psychology	and safety gears should be available: • Workshop • Tool box • Tools • Multimeter • Workshop machines i e - Grinding machine - Drilling machine - Valve grinder - Drum and disc service machine - Wheel balancing machine - Wheel alignment machine/gauge - Head light aiming machine - Testing benches - Bench vices - Anvil - Hydraulic press • Surface block	

							• First aid kit • Firefighting equipment • Emergency exit • Overhead projector • Computer • TV • Organizatio n structure • Safety gears	
	8.5. Maintaining records	(a). Collecting Information	**Brainstorm:** Guide the students to define records of workshop materials Explain how to collect information and explain techniques used to collect Information **Practical work:** Guide the student on procedure/ steps to collect Information **Activity:** Organize the students in manageable groups to collect information of	**The student should be able to:** • Select tools and equipment • Collect information • Write technical reports • Prepare budget report • Prepare action plan • Keep records	The prepared reports contain required contents as per management requirements	**Knowledge evidence: Detailed knowledge of:** **Method used:** The student should explain: • Preparation of technical reports • Keeping of records **Principles:** The student should explain the principles of: • Supervision • Reporting **Theories:** The student should explain: • Importance of reports • Contents of reports • Writing of technical reports • Types of reports and their uses	This element can be achieved at a work place or training institution. The following materials, tools, and equipment and safety gears should be available: • Office/table and chairs • Stationery • Computer • Job card • Subordinate s reports • Binding machine • Photocopy machine • Overcoat • Safety boots	**9**

		the welding work shop			**Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions while preparing reports • Safe handling of tools, equipment and documents • Waste disposal		
	(b). Producing technical report	**Brainstorm:** Guide the students to define technical report Explain how to produse technical report and explain techniques used to produce technical report **Practical work:** Guide the student on procedure/ steps to produce technical report **Activity:** Organize the students in manageable groups to produse technical report of	**The student should be able to:** • Select tools and equipment • Collect information • Write technical reports • Prepare budget report • Prepare action plan • Keep records	The prepared reports contain required contents as per management requirements	**Knowledge evidence:** **Detailed knowledge of:** **Method used:** The student should explain: • Preparation of technical reports • Keeping of records **Principles:** The student should explain the principles of: • Supervision • Reporting **Theories:** The student should explain: • Importance of reports • Contents of reports • Writing of technical reports • Types of reports and their uses	This element can be achieved at a work place or training institution The following materials, tools and equipment and safety gears should be available: • Office/table and chairs • Stationery • Computer • Job card • Subordinates reports • Binding machine • Photocopy machine • Overcoat • Safety boots	

			the welding work shop			**Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions while preparing reports • Safe handling of tools, equipment and documents • Waste disposal		
		(c). Obtaining service manuals and diagnostic software	**Brainstorm:** Guide the students to define service manuals and diagnostic software Explain how to obtain service manuals and diagnostic software and explain techniques used to obtain service manuals and diagnostic software **Practical work:** Guide the student on procedure/ steps to obtain service manuals	**The student should be able to:** • Select tools and equipment • Collect information • Write technical reports • Prepare budget report • Prepare action plan • Keep records	The prepared reports contain required contents as per management requirements	**Knowledge evidence:** **Detailed knowledge of:** **Method used:** The student should explain: • Preparation of technical reports • Keeping of records **Principles:** The student should explain the principles of: • Supervision • Reporting **Theories:** The student should explain: • Importance of reports • Contents of reports • Writing of technical reports	This unit can be achieved at a work place or training institution. The following materials, tools, and equipment and safety gears should be available: • Office/table and chairs • Stationery • Computer • Job card • Subordinates reports • Binding machine • Photocopy machine • Overcoat • Safety boots	

			and diagnostic software **Activity:** Organize the students in manageable groups to obtain service manuals and diagnostic software of the welding work shop			• Types of reports and their uses **Circumstantial knowledge:** **Detailed knowledge about:** • Safety precautions while preparing reports • Safe handling of tools, equipment and documents • Waste disposal		
	8.6. Managing workshop business	(a). Performing entrepreneurial tactics	**Brainstorm:** Guide the students to define business Explain how to Perform entrepreneurial tactics and explain techniques used to Perform entrepreneurial tactics **Practical work:** Guide the student on procedure/ steps to perform entrepreneurial tactics	**The student should be able to:** • Calculate total project cost • Prepare project write up • Select appropriate site for establishing workshop • Acquire land/building for setting the workshop • Purchase basic hand tools and equipment • Perform manpower planning • Prepare at least six months' salary for	Managed workshop business conforms to stipulated regulations	**Knowledge evidence:** **Detailed knowledge of:** **Method used:** The student should explain how to: • Establish and run workshop business • Analyze profit and loss **Principles:** The student should explain principles used to: • Acquire capital from the Bank or an NGO • Calculate business profit and loss • Manage private business	This element can be achieved at a work place or in a training institution. The following tools, equipment, and safety gears should be available: • Workshop layout chart • Business films/video cassettes • Business magazines • Workshop business regulations • Scheduled maintenance of machines	**9**

			Activity: Organize the students in manageable groups to perform entrepreneurial tactics business of the welding work shop	potential workers • Supervise provision of payment invoices and receipts • Identify labour and overhead costs • Analyze profit and loss		workshop • Manage non private business workshop **Theories:** The student should explain: • Meaning of "business" • Meaning of workshop • Project writes up procedures • Good customer care **Circumstantial knowledge:** **Detailed knowledge about:** • Marketing and use of mass media • Safe handling of business capital • Waste proposal	• Job card sheets • Stationeries • Receipt book • Invoice books • Workshop tools and equipment • Personal computer • Workshop store • Workshop office • Tool ledger book • Safety gears	
		(b). Conducting manpower planning	**Brainstorm:** Guide the students to define business Explain how to Conduct manpower planning and explain techniques used to conduct manpower planning	**The student should be able to:** • Calculate total project cost • Prepare project write up • Select appropriate site for establishing workshop • Acquire land/building for setting the	Manpower planning conforms to stipulated regulations	**Knowledge evidence:** **Detailed knowledge of:** **Method used:** The student should explain how to: • Establish and run workshop business • Conduct manpower planning • Analyze profit	This element can be achieved at a work place or in a training institution. The following tools, equipment, and safety gears should be available: • Workshop layout chart • Business	

			Practical work: Guide the students on procedure/ steps to perform conducting manpower planning **Activity:** Organize the students in manageable groups to perform manpower planning of the welding work shop	workshop • Purchase basic hand tools and equipment • Perform manpower planning • Prepare at least six months' salary for potential workers • Supervise provision of payment invoices and receipts • Identify labour and overhead costs • Analyze profit and loss		and loss **Principles:** The student should explain principles used to: • Conduct manpower planning • Manage private business workshop • Manage non private business workshop **Theories:** The student should explain: • Meaning of Conduct manpower planning • Meaning of workshop • Project writes up procedures • Good customer care **Circumstantial knowledge:** **Detailed knowledge about:** • Marketing and use of mass media • Safe handling of business capital	films/video cassettes • Business magazines • Workshop business regulations • Scheduled maintenance of machines • Job card sheets • Stationeries • Receipt book • Invoice books • Workshop tools and equipment • Personal computer • Workshop store • Workshop office • Tool ledger book • Safety gears	
		(c). Supervising Junior workers	**Brainstorm:** Guide the students to	**The student should be able to:** • Select	Managed workshop business	**Knowledge evidence:** **Detailed knowledge of:**	This element can be achieved at a work place or in	

			define Junior workers, how to supervise junior workers and explain techniques used to supervise junior workers **Practical work:** Guide the students on procedure/ steps to supervise junior workers **Activity:** Organize the students in manageable groups to supervise junior workers of the welding workshop	appropriate site for establishing workshop • Acquire • manpower planning • Prepare at least six months' salary for potential workers • Supervise provision of payment invoices and receipts • Identify labour and overhead costs • Analyze profit and loss	conforms to stipulated regulations	**Method used:** The student should explain how to: • Establish and run workshop business • Supervise Junior workers **Principles:** The student should explain principles used to: • Supervise Junior workers • Manage non private business workshop **Theories:** The student should explain: • Meaning of "business" • Meaning of workshop • Project writes up procedures • Good customer care **Circumstantial knowledge:** **Detailed knowledge about:** • Marketing and use of mass media • Safe handling of business capital	a training institution. The following tools, equipment, and safety gears should be available: • Workshop layout chart • Business films/video cassettes • Business magazines • Workshop business regulations • Scheduled maintenance of machines • Job card sheets • Stationeries • Receipt book • Invoice books • Workshop tools and equipment • Personal computer • Workshop store • Workshop office • Tool ledger book	

							• Safety gears	
9. Managing safe work environment	9.1. Managing hazards	(a). Controlling mechanical hazards	**Brainstorm:** Guide the students to define, explain mechanical hazards **Practical work**: Guide student on how to control mechanical hazards **Activity:** Organize the students in manageable groups to identify mechanical hazards in school premises	**The student should be able to:** • Interpret service manuals • Select tools and equipment • Use OSHA rules and regulations • Prepare workshop inspection report • Prepare workshop color code and safety signs • Identify any safety hazard materials • Handle hazards material • Prepare preventive maintenance schedule • Identify and apply all emergency equipment and supplies • Conduct safety awareness training to sub-ordinates • Monitor safety environment • Manage uses of safety gears	Hazards, risks, incident and accidents are managed according to OSHA's rules and regulations	**Knowledge evidence: Detailed knowledge of:** **Method used:** The student should explain how to: • Interpret OSHA rules and regulations • Use safety gears • Prepare preventive maintenance schedule and inspection report • Prepare warning signs and safety instructions • Conduct assessment • Carry out accident investigation • Monitor safe working environment • Manage uses of safety gears **Principles:** The student should explain the principles of: • Preparing inspection check lists • Preparing warning signs	This element can be achieved at a work place or in a training institution. The following tools, equipment, and safety gears should be available: • Electrical equipment • Mechanical equipment • Power machines • Measuring tools • Cutting tools • First aid kit • Fire extinguishers • Service manuals • OSHA rules and regulations • Helmet • Gloves • Ear plug • Mask Gloves	**30**

				• Cleaning tools and equipment • Storing tools and equipment		and safety instructions • Identifying hazards materials • Preparing and conducting training • Handing hazard materials **Theories:** The student should explain: • Function of inspection check list • Importance of posting warning sign and safety instructions • Advantages of risk assessment • Importance of carry out accident investigation • Importance of monitor safety at working place **Circumstantial knowledge** **Detailed knowledge about:** • Safety precautions while manage hazards • Safe handling of tools and equipment		

						• Waste disposal		
		(b). Controlling chemical hazards	**Brainstorm:** Guide the students to define, explain chemical hazards **Practical work:** Guide the student on how to handle chemical hazards **Activity:** Organize the students in manageable groups to identify chemical hazards in school premises	**The student should be able to:** • Interpret service manuals • Select tools and equipment • Use OSHA rules and regulations • Prepare workshop inspection report • Prepare workshop color code and safety signs • Identify any safety hazard materials • Handle hazards material • Prepare preventive maintenance schedule • Identify and apply all emergency equipment and supplies • Conduct safety awareness training to sub-ordinates • Monitor safety environment • Manage uses of safety gears	chemical hazards, risks, incident and accidents are managed according to OSHA's rules and regulations	**Knowledge evidence: Detailed knowledge of:** **Method used:** The student should explain how to: • Interpret OSHA rules and regulations • Use safety gears • Prepare preventive maintenance schedule and inspection report • Prepare warning signs and safety instructions • Conduct assessment • Carry out accident investigation • Monitor safe working environment • Manage uses of safety gears **Principles:** The student should explain the principles of: • Preparing inspection check lists • Preparing warning signs	This unit can be achieved at a work place or in a training institution. The following tools, equipment, and safety gears should be available: • Electrical equipment • Mechanical equipment • Power machines • Measuring tools • Cutting tools • First aid kit • Fire extinguishers • Service manuals • OSHA rules and regulations • Helmet • Gloves • Ear plug • Mask Gloves	

				• Cleaning tools and equipment • Storing tools and equipment		and safety instructions • Identifying hazards materials • Preparing and conducting training • Handing hazard materials **Theories:** The student should explain: • Function of inspection check list • Importance of posting warning sign and safety instructions • Advantages of risk assessment • Importance of carry out accident investigation • Importance of monitor safety at working place **Circumstantial knowledge** **Detailed knowledge about:** • Safety precautions while manage hazards • Safe handling of tools and equipment • Waste disposal	

		(c). Controlling Physical hazards	**Brainstorm:** Guide the students to define, explain physical hazards **Practical work:** Guide the student on how to handle physical hazards **Activity:** Organize the students in manageable groups to identify physical hazards in school premises	**The student should be able to:** • Interpret service manuals • Select tools and equipment • Use OSHA rules and regulations • Prepare workshop inspection report • Prepare workshop color code and safety signs • Identify any safety hazard materials • Handle hazards material • Prepare preventive maintenance schedule • Identify and apply all emergency equipment and supplies • Conduct safety awareness training to sub-ordinates • Monitor safety environment • Manage uses of safety gears • Cleaning tools	Physical Hazards, risks, incident and accidents are managed according to OSHA's rules and regulations	**Knowledge evidence: Detailed knowledge of:** **Method used:** The student should explain how to: • Interpret OSHA rules and regulations • Use safety gears • Prepare preventive maintenance schedule and inspection report • Prepare warning signs and safety instructions • Conduct assessment • Carry out accident investigation • Monitor safe working environment • Manage uses of safety gears **Principles:** The student should explain the principles of: • Preparing inspection check lists • Preparing warning signs and safety instructions	This unit can be achieved at a work place or in a training institution. The following tools, equipment, and safety gears should be available: • Electrical equipment • Mechanical equipment • Power machines • Measuring tools • Cutting tools • First aid kit • Fire extinguishers • Service manuals • OSHA rules and regulations • Helmet • Gloves • Ear plug • Mask Gloves	

				and equipment • Storing tools and equipment		• Identifying hazards materials • Preparing and conducting training • Handing hazard materials **Theories:** The student should explain: • Function of inspection check list • Importance of posting warning sign and safety instructions • Advantages of risk assessment • Importance of carry out accident investigation • Importance of monitor safety at working place **Circumstantial knowledge** **Detailed knowledge about:** • Safety precautions while manage hazards • Safe handling of tools and equipment • Waste disposal		

9. Managing safe work environment	9.2. Carrying out risk assessment	(a). Identify and Controlling risk	**Brainstorm:** Guide the students to define, explain risk assessment **Practical work:** Guide the student on how to identify and controlling risks **Activity:** Organize the students in manageable groups to identify and controlling risks in school premises	**The student should be able to:** • Interpret service manuals • Select tools and equipment • Supervise practice safe workshop practices to protect yourself, other and properties • React correctly and safely when faced with an emergency • Identify and apply correctly all emergency equipment and supplies • Make periodic inspections of workshop area and all equipment and prepare report • Conduct safety training • Identify any safety hazard material • Handle hazard material correctly • Prepare universal workshop color	Risk assessment carried out as per OSHA standard and automobile regulations	**Knowledge evidence:** **Detailed knowledge of:** **Method used:** The student should explain how to: • Identify safety hazard material • Handle hazard material • Prepare inspection check list **Principles:** The student should explain the principles of: • Dealing with an emergency situation • Conducting safety training • Hazards Identification procedures **Theories:** The student should explain: • Carryout risk assessment • Conducting safety training • Inspecting workshop areas tools and equipment • Handling Hazard material correctly **Circumstantial knowledge**	This element can be achieved at a work place or in a training institution. The following tools, equipment, and safety gears should be available: • Service manuals • OSHA regulations • Workshop rules • Camera • Risk assessment sheet • Mask • Ear plug • Gloves • Overall • Safety boots • Safety clear glasses	**30**

			codes and know what the color represent • Make out and file safety report • Be aware of the dangerous of compressed air • Ensure availability of personal protective equipment • Supervise compressed air rules • Monitor good environmental practices • Clean tools and equipment • Store tools and equipment		**Detailed knowledge about:** • Safety precautions while carrying out risk management • Safe handling of tools and equipment • Waste disposal		
	(b). Managing toolbox meeting.	**Brainstorm:** Guide the students to define, explain toolbox meeting **Practical work:** Guide the student on how to manage toolbox meeting **Activity:** Organize the students in manageable	**The student should be able to:** • Interpret service manuals • Select tools and equipment • Supervise practice safe workshop practices to protect yourself, other and properties • React correctly and safely when	Manage toolbox meeting carried out as per OSHA standard and automobile regulations	**Knowledge evidence:** **Detailed knowledge of:** **Method used:** The student should explain how to: • Identify safety hazard material • Handle hazard material • Prepare inspection checklist **Principles:** The	This unit can be achieved at a work place or in a training institution The following tools, equipment and safety gears should be available: • Service manuals • OSHA regulations • Workshop	

				groups to manage toolbox meeting in school premises	faced with an emergency • Identify and apply correctly all emergency equipment and supplies • Make periodic inspections of workshop area and all equipment and prepare report • Conduct safety training • Identify any safety hazard material • Handle hazard material correctly • Prepare universal workshop color codes and know what the color represent • Make out and file safety report • Be aware of the dangerous of compressed air • Ensure availability of personal protective equipment • Supervise compressed air		student should explain the principles of: • Dealing with an emergency situation • Conducting safety training • Hazards Identification procedures **Theories:** The student should explain: • Carryout risk assessment • Conducting safety training • Inspecting workshop areas tools and equipment • Handling Hazard material correctly **Circumstantial knowledge** **Detailed knowledge about:** • Safety precautions while carrying out risk management • Safe handling of tools and equipment • Waste disposal	rules • Camera • Risk assessment sheet • Mask • Ear plug • Gloves • Overall • Safety boots • Safety clear glasses	

				rules • Monitor good environmental practices • Clean tools and equipment • Store tools and equipment				
	9.3. Managing environmental issues	(a). Managing air pollution	**Brainstorm:** Guide the students to define, explain air pollution **Practical work:** Guide the student on how to manage air pollution **Activity:** Organize the students in manageable groups to manage air pollution in school premises	**The student should be able to:** • Select tools and safety gears • Identify environmental hazards • Handle environmental hazards • Handle different types of wastes as per EMA • Manage the environment • Conduct safety awareness training to subordinates • Clean tools and equipment • Store tools and safety gears	Air pollution managed as per EMA rules and regulations	**Knowledge evidence: Detailed knowledge of:** **Method used:** The student should explain how to: • Interpret EMA rules and regulations • Monitor safe working environment • Control air pollution • Control different types of waste **Principles:** The student should explain the principles of: • Managing air pollution • Handling environmental safety work • Preparing and conducting training • Handling	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gears should be available: • Cleaning Tool kit • Gumboots/ Safety boots • Gloves • Overalls • Cleaning materials • Hoe • Broom • Brush • Safety gears • Dust covers • Dust mask • Wheel barrow	**30**

						different types of waste **Theories:** The student should explain: • Student should explain importance of safe work environment • Explain types of air pollution • Advantages of monitoring environmental pollution • Importance of preparing environmental schedule • Importance of control different types of wastes **Circumstantial knowledge** **Detailed knowledge about:** • Safety knowledge while managing environmental pollution • Safe handling of cleaning tools and equipment • Waste disposal		

		(b). Managing water pollution	**Brainstorm:** Guide the students to define, explain water pollution **Practical work:** Guide the student on how to manage water pollution **Activity:** Organize the students in manageable groups to manage water pollution in school premises	**The student should be able to:** • Select tools and safety gears • Identify environmental hazards • Handle environmental hazards • Handle different types of wastes as per EMA • Manage the environment • Conduct safety awareness training to subordinates • Clean tools and equipment • Store tools and safety gears	Water pollution managed as per EMA rules and regulations	**Knowledge evidence: Detailed knowledge of:** **Method used:** The student should explain how to: • Interpret EMA rules and regulations • Monitor safe working environment • Control water pollution • Control different types of waste **Principles:** The student should explain the principles of: • Managing water pollution • Handling environmental safety work • Preparing and conducting training • Handling different types of waste **Theories:** The student should explain: • Student should explain importance of safe work environment • Explain types of water pollution	This element can be achieved at a work place or training institution. The following tools, equipment, and safety gears should be available: • Cleaning Tool kit • Gumboots/ Safety boots • Gloves • Overalls • Cleaning materials • Hoe • Broom • Brush • Safety gears • Dust covers • Dust mask • Wheel barrow

						• Advantages of monitoring environmental pollution • Importance of preparing environmental schedule • Importance of control different types of wastes **Circumstantial knowledge** **Detailed knowledge about:** • Safety knowledge while managing water pollution • Safe handling of cleaning tools and equipment • Waste disposal	
		(c). Managing land pollution	**Brainstorm:** Guide the students to define, explain land pollution **Practical work:** Guide the student on how to manage land pollution **Activity:**	**The student should be able to:** • Select tools and safety gears • Identify environmental hazards • Handle environmental hazards • Handle different types of wastes	Land pollution managed as per EMA rules and regulations	**Knowledge evidence:** **Detailed knowledge of:** **Method used:** The student should explain how to: • Interpret EMA rules and regulations • Monitor safe working environment	This unit can be achieved at a work place or training institution. The following tools, equipment, and safety gears should be available: • Cleaning Tool kit	

			Organize the students in manageable groups to manage land pollution in school premises	as per EMA • Manage the environment • Conduct safety awareness training to subordinates • Clean tools and equipment • Store tools and safety gears		• Control environment Land pollution • Control different types of waste **Principles:** The student should explain the principles of: • Managing land pollution • Handling environmental safety work • Preparing and conducting training • Handling different types of waste **Theories:** The student should explain: • Student should explain importance of safe work environment • Explain types of environment pollution • Advantages of monitoring land pollution • Importance of preparing environmental schedule • Importance of control different types of wastes	• Gumboots/ Safety boots • Gloves • Overalls • Cleaning materials • Hoe • Broom • Brush • Safety gears • Dust covers • Dust mask • Wheel barrow	

						Circumstantial knowledge **Detailed knowledge about:** • Safety knowledge while managing land pollution • Safe handling of cleaning tools and equipment • Waste disposal		

References

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