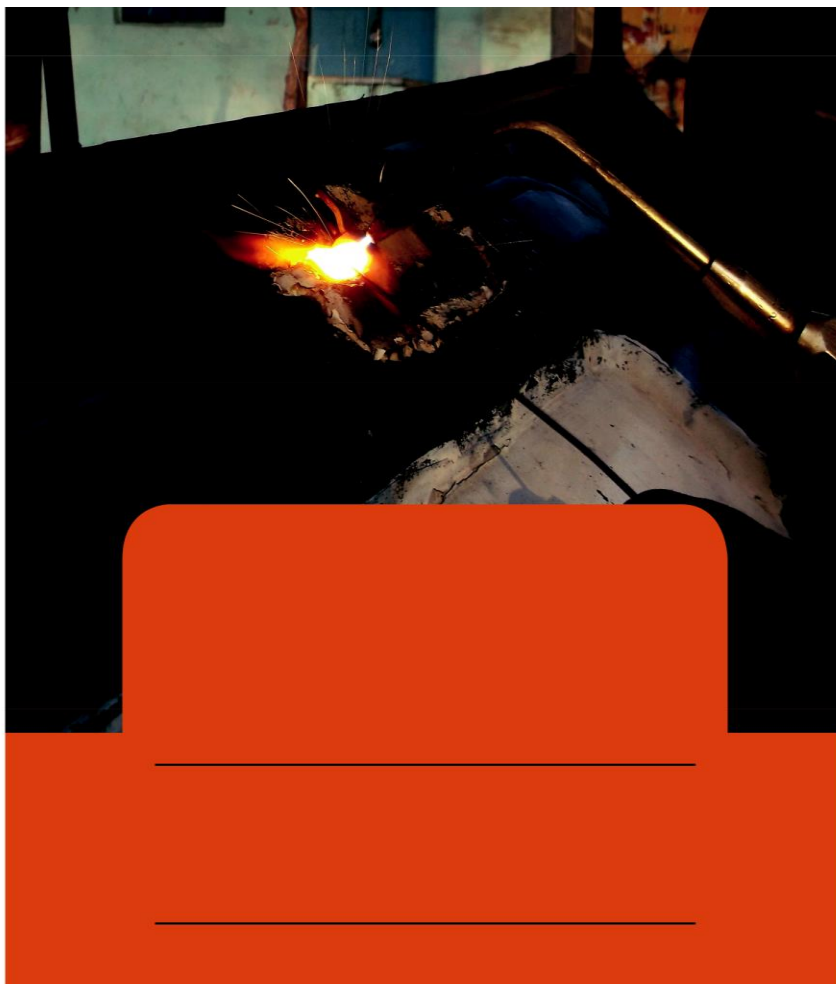


**MODULAR ASSESSMENT SYLLABUS FOR NATIONAL CERTIFICATE IN WELDING AND
FARICATION (NCWF)**

Technical, Vocational Education and Training (TVET)



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FOREWORD

I congratulate the Uganda Business and Technical Examinations Board (UBTEB) for making the National Certificate (NC) programmes into modularised assessment to enhance the Competencies of the graduates in line with NDPIII and the TVET reforms. This is what is envisaged when Government resolved to approve the Technical, Vocational Education and Training (TVET) Policy, 2019. The reforms of modularising TVET training and assessment will build the confidence among parents and trainees so that we can attain relevant competencies in the short term at a minimal cost in various occupations of interest. I implore all Principals, Instructors and Assessors to embrace the new reform and employ the best methodology in both training and assessment in line with the Policy direction.

The increasing numbers of Industrial undertakings and other enterprises require the workforce with the right skills and competencies demanded by the world of work. Therefore this modularised assessment of the programmes under the Vocational Institutions / Skills Development Centres were premised on the current labour market demand making it trainee centred and competence. The modularisation of assessment is therefore a key strategy to increase access to TVET and hence force reduce on youth unemployment. I therefore endorse this modularisation of assessment by the Uganda Business and Technical Examinations Board.

J.K. Museveni

First Lady and Minister of Education and Sports

ACKNOWLEDGMENT

On behalf of Uganda Business and Technical Examinations Board, I wish to acknowledge the relentless contribution of key stakeholders towards the development of the modules at National Certificate/Skills Development Centre level. The First Lady and Minister of Education is appreciated for steering the Technical, Vocational Education and Training (TVET) Policy reforms that among others, require that training and assessment be made flexible, self-paced, affordable and practical for employability. I thank the Ministry Technical team for the guidance and financing of the modularised approach. The Instructors and the experts from the world of work did a commendable job in transforming the earlier traditional programmes assessed into this modularised assessment. I am indebted to the UBTEB Staff headed by the Director of Examinations Management who coordinated the entire activity to attract the assessment experts, the industry and Instructors. It is expected that the trainee doesn't need to finish the entire two years for one to join the world of work. The programmes are packaged in modules to enable a trainee focus on achieving the skills and competencies that equip him/her to employ them to a specific occupation. He/she could join the practicing world of the occupation with a Competence Based Assessment Certificate and later, s/he may return to pursue the training and assessment of other competencies in different modules or a combination of modules. I urge all instructors, Assessors, the industry and the trainees to embrace the new changes in this modular system in order to enhance relevance and employability of graduates.

Onesmus Oyesigye (CPA)

Executive Secretary

1.0 PROGRAMME OVERVIEW

This Modular Assessment Guide has been prepared to guide training institutions preparing trainees for Uganda Business and Technical Examinations Board (UBTEB) assessment and the industry. The 2016 National Curriculum Development Centre content for National Certificate in Welding and Fabrication was divided into modules to develop the guide. The modules are flexible to allow free entry and exit of learners to the world of work after attaining employable skills. Each module is independent but emphasising competences and the trainee has a choice to pick which to start with; putting into account the available resources and time they have to complete the training. At the end of each module, the trainee who successfully completes the training is given a competence certificate in that particular training. But those who successfully complete all the four modules will be awarded with a National Certificate in Welding and fabrication.

1.1 The Modularization of Assessment

The modularization of assessment is intended to bring together particular set of skills and competencies that can lead to an occupation or job as a complete package. The completion of such packages by the trainee leads to a certificate of competence in that particular module. It is upon the trainee to continue pursuing training for other packages or to join the world of work for any gainful employment. This will help the trainees to compile their learning achievements and those that may not be able to undertake the entire training can join the world of work and come back later when they need more sets of skills. The trainee will be given a competence certificate on completion of all the packages under that certificate. This will also help in the recognition of prior learning for those who join with some experience into the training.

In addition, the modularization of assessment is meant to integrate other skills like entrepreneurship, communication, computer skills and work ethics through a typical work process which can lead to production of a holistically trained graduate who can perform to the required standard of the world of work.

The programmes that have been modularised are those under the National Certificates which take a duration of two years to complete an entire Certificate. These programmes have a number of skills and competencies that lead to specific occupations or jobs however, the way the content is packaged does not lead to a particular set of skills which can lead to the occupation or a job. The world of work today is looking for a person with specific set of skills who can perform to a required standard.

2.0 THE MODULES

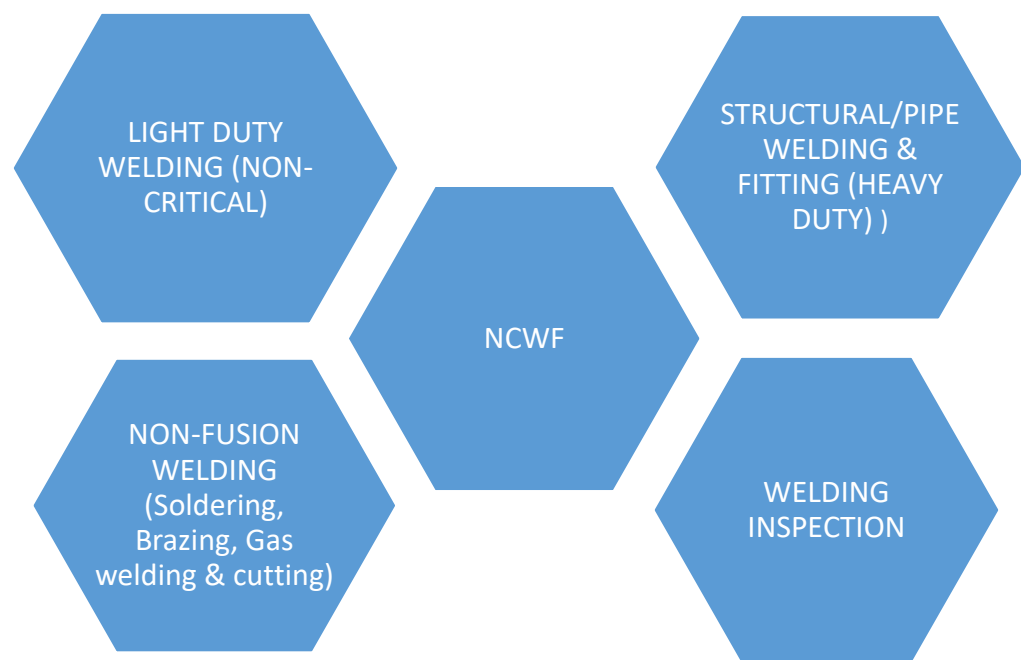


Fig. 1: Diagram showing the different module stages

2.1 Modules and their Expected Outcome

S/N	Module	Expected outcome	Award
1	INTRODUCTION TO WELDING	Design, cut, shape and join metals by light welding such as doors, windows, gates and burglar frames.	Certificate of Competence in light duty welding
2.	Non fusion welding and cutting operations (soldering, brazing and gas cutting)	Join together components to assemble fabricated metal parts using soldering iron, torch, or welding machine and flux. Cut materials professionally into pieces of specific dimensions and shape.	Certificate of Competence in Non fusion welding and Gas cutting
3.	Structural/Pipe welding and fitting (Heavy duty)	Lay out, fit, and fabricate metal components to assemble structural forms, such as machinery frames, bridge parts, and pressure vessels, using knowledge of welding techniques, metallurgy, and engineering requirements. Lay out, assemble, install, and maintain pipe systems, pipe supports, and related hydraulic and pneumatic equipment for steam, hot water, heating, cooling, lubricating, sprinkling, and industrial production and processing systems. Fabricate, lay out, position, align, and fit parts of structural metal products.	Certificate of Competence in Structural/Pipe welding and fitting
4.	Welding inspection	Inspect weldments and welding related activities to ensure that they comply with	Certificate of Competence in Welding inspection

2.1.1 MODULE ONE: WF 1110 - LIGHT DUTY WELDING

Training Outcome:

By the end of this module, the trainee should be able to design, cut, shape and join metals by spot welding such as doors, windows, gates and burglar frames.

Sub-modules	Task	Competences	Syllabus Indicative Content	Duration
1. Safety, Health and Environment (HSE) for Welders	Prevent Common Workplace Hazards	• Observes safety and health regulations during practice and performs good housekeeping. • Uses the right safety gear at the workplace. • Applies correct methods of handling welding materials, tools and equipment according to recommendations. • Recognizes and describes hazardous and non-hazardous materials at the workplace. • Standardizes the work permit system. • Identifies and applies the 5S system in SHE management. • Identifies possible causes of accidents in sites and workshops. • Identifies potential risks at the workplace.	• Introduction to health, safety and environment (HSE) culture • Personal protection equipment (PPE) • Safety when handling welding materials • Welding equipment and tools safety • Hazard recognition • Work permit system • Introduction and implementation of 5S • Causes of accidents in workplaces • Assessment of potential risks • Application of safe job analysis	10Hrs

		• Applies the safe job analysis (SJA) while working on his /her daily activities. • Handles and prevents contamination of toxic substances. • Explains the dangers of drug abuse and drug addiction. • Prevents drug abuse and drug addiction. • Sensitizes others about the dangers of drug abuse and drug addiction.		
2. First Aid		• Describes the importance of first aid. • Identifies and classifies injuries. • Describes the preventive measures and treatment given to specific injury. • Administers first aid. • Reports of first aid provided to the casualties. • Refers cases to the medical facilities.	• Introduction to first aid • Treatment of arc eye, burns/scalds • Electrical injuries • Shock • Body failures (heart, breathing, paralysis, epilepsy, convulsion, fainting) • Bleeding and wounds • Fractures	6Hrs
3. Introduction to Welding Processes		• Describes the historical development of welding and the future of the industry. • Selects appropriate welding methods, processes and consumables for a given task based on quality, availability, cost and compatibility. • Differentiates welding methods, processes and consumables. • Identifies welding power sources and welding machines.	• Historical development of welding and the future of the industry • Welding processes (shielded metal arc welding, gas welding, • resistance welding, metal arc gas welding, metal inert gas welding,	4Hrs

		• Uses different types of welding machines for a given job/material. • Connects and operates gas welding equipment and accessories. • Identifies welding tools and equipment according to their groups and application.	• tungsten inert gas welding, submerged arc)	
4. Welding Machines and Equipment		• Selects appropriate welding methods, processes and consumables for a given task based on quality, availability, cost and compatibility. • Differentiates welding methods, processes and consumables. • Identifies welding power sources and welding machines. • Uses different types of welding machines for a given job/material. • Connects and operates gas welding equipment and accessories. • Identifies welding tools and equipment according to their groups and application.	Power sources for arc welding (grid, generators, batteries) • Type of welding machines (transformer, rectifier, inverter, resistance, seam welding machines) • Gas welding equipment (manifold and mobile)	6Hrs
5. Introduction to Arc Welding Technology and Practice; Shielded Metal Arc Welding (SMAW) up to 6mm Plate Thickness		• Describes the historical development of welding and the future of the industry. • Selects the welding machine and suitable power source. • Explains welding current and physics of welding. • Identifies butt, fillet, lap, corner joints and welds joints in flat and horizontal positions.	• Historical development of welding and the future of the industry • The electric arc and arc development (current and physics of welding) • Arc welding electrodes (consumable and non-consumable) • Arc welding joints: butt, fillet, lap, corner	20Hrs

		- Identifies consumable and non-consumable electrodes. - Classifies surface and sub-surface welding defects.	Introduction to arc welding defects: surface and sub-surface	
6. Tools, Devices and Equipment		- Identifies, selects appropriately and uses striking, fixing and forming tools. - Uses striking, fixing and forming tools. - Identifies and uses different measuring tools. - Identifies, selects appropriately and uses gauges. - Identifies, selects and uses machines and power tools. - Identifies, selects appropriately and uses power tools. - Identifies, selects and uses workshop devices, equipment and accessories. - Operates and maintains some machines in the workshop.	- Hand tools (striking, fixing, cutting, forming) Forging tools - Measuring tools (vernier callipers, rules, micro metre screw gauges, squares, tape measures) - Gauges (spirit level, plumb bob, dial gauges) - Machine tools (cutting, grinding, shearing, polishing, forming, fitting) - Power tools (construction, use, maintenance) - Workshop devices, equipment and accessories (surface plate, anvil, - press, vice, clamps, saw, pedestal grinder)	12HRS
7. Marking Out		- Identifies and selects marking out tools and equipment. - Correctly uses marking out tools.	Marking out tools and equipment (scribers, straight edges, punches, trammels dividers, surface plates, surface	08Hrs

		• Accurately transfers measurements to the work piece. • Constructs templates accurately.	gauges, calculator, chord rule, chalk, prick punch, combination square, protractor ball peen hammer) • Templates	
8. Welding Positions (thick plate up to 9mmt)		• Identifies types of welded joints. • Prepares edges and welds joints. • Performs welding in flat, horizontal, vertical, and overhead positions.	• Safety practices when welding in different positions • Flat, horizontal, vertical and overhead welding positions	6hrs
9. Fabrication of Furniture and Simple Objects		• Interprets working drawings. • Transfers measurements from working drawings to work pieces. • Fabricates different items. • Describes general guiding principles of furniture fabrication. • Fabricates different types of furniture (office and domestic). • Describes general guiding principles of door and window frames/shutter fabrication. • Describes general guiding principles of door and window burglar proofing fabrication.	• Guiding principles and practice of office furniture fabrication (chairs, desks, shelves, cabinets, tables) • Guiding principles and practice of domestic furniture fabrication (chairs, shelves, cabinets, tables, beds) • Door and window frames/shutters - Burglar proofing	20Hrs
10. Introduction to engineering drawing		• Describes the importance of drawing as an engineering language. • Describes and identifies drawing instruments. • Sets drawing paper on drawing board.	• Definition and aims of engineering drawing • The instruments and equipment used in drawing	50Hrs

		• draws lines and prints letters • Draws paper layouts. • Describes and identifies types of engineering drawing lines. • Draws objects in 1st and 3rd angle projections. • Interprets objects in first and third angle projections. • Represents correctly and indicates the correct symbol for first and third angle projections. • Interprets and draws views of sectioned objects in 1st and 3rd angle projections. • Draws objects in three dimensions.	• Setting/ layout of drawing paper • Lines and lettering • Drawing lay-out (title block, scale, outline • Construction of lines • Construction of angles; • Basic geometrical design • Principles of tangency • Construction of tangents and application • Constructions of polygons • Introduction to three-dimension drawing	
11. Introduction to Engineering Materials		• Practices general safety when handling materials. • Identifies different types of wastes. • Practices safe hazardous waste pickup and disposal. • Identifies different fabrication materials. • Classifies engineering materials. • Relates the properties of metals to their production processes. • Correctly selects suitable materials for a given job.	• General safety practices when handling materials • Types of wastes • Hazardous waste pickup and disposal • Classification of materials • Properties of common engineering metals (iron, aluminium, copper, tin, zinc, tungsten, bearing metals, lead, magnesium-base alloys, copper-base alloys, wood and plastics, among others)	50Hrs

			Factors affecting selection of materials	
12. Ferrous and Non-ferrous metals and alloys		- Describes the production and properties of iron. - Identifies and classifies ferrous metals. - Describes effects of alloying elements on ferrous metals. - Describes microscopic structures of ferrous metals. - Describe applications of ferrous and Non-ferrous metals and alloys..	- Introduction to ferrous metals - Production of iron - Microscopic structures - Ferrous alloys - Iron carbon diagram. - Applications	40Hrs
13. Technical drawing		- Describes the importance of drawing as an engineering language. - Describes and identifies drawing instruments. - Sets drawing paper on drawing board. - draws lines and prints letters - Draws paper layouts. - Describes and identifies types of engineering drawing lines. - Performs geometric constructions	- interpreting and drawing views of objects in 1st and 3rd angle projections - Interpreting and drawing views of sectioned objects in 1st and 3rd angle projections - Principles of isometric and oblique projections, construction of objects composed of isometric lines and isometric circles - Pictorial drawings interpretation and drawing and 3D drawings	34Hrs

			• Freehand sketching and drawing and 3D drawings	
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2.1.3 MODULE TWO: WF 2110 – SOLDERING, GAS WELDING, BRAZING AND GAS SHIELDED METAL ARC WELDING.

Training Outcome:

Join together components to assemble fabricated metal parts using soldering iron, torch, or welding machine and flux.

Cut materials professionally into pieces of specific dimensions and shape.

Sub-module	Tasks	Competences	Syllabus indicative content	Duration
1. Ferrous and Non-ferrous Metals		• Practices general safety considerations taken during production of metals. • Identifies toxic metals and describes safety precautions. • Describes the production process of aluminium, its additives and properties. • Describes the production of copper and magnesium, their additives and properties. • Describes production of cast iron and stainless steel, their additives and properties.	• General safety considerations taken during production of metals • Toxic metals and safety considerations • Production of aluminium and its alloys • Production of copper and its alloys Production of magnesium and its alloys Production of stainless steel	16Hrs

		- Identifies different types of stainless steel and their applications. - Describes the behaviour of aluminium, copper, magnesium, cast iron, stainless steel and their alloys during welding. - Takes caution when fabricating aluminium, copper, magnesium, cast iron, stainless steel and their alloys. - Describes and observes the conditions required for welding of aluminium, copper, magnesium, cast iron, stainless steel and their alloys.		
2. Weldability of Ferrous and Non-ferrous Metals		- Selects appropriate welding processes for aluminium, copper, magnesium, cast iron, and stainless steel and their alloys. - Follows procedures of welding aluminium, copper, magnesium, cast iron, stainless steel and its alloys using several methods.	- Weldability of aluminium and its alloys - Weldability of copper and its alloys - Weldability of magnesium alloys - Weldability of cast iron - Weldability of stainless steel	16Hrs
3. Soldering		- Describes various soldering methods applied in industry. - Identifies the soldering filler metals and fluxes used in soldering.	- Introduction to soldering procedures - Types of soldering (dip soldering, furnace soldering, induction)	10Hrs

		• Selects soldering filler metals. • Chooses the appropriate type of soldering for a given task. • Applies soldering techniques on job.	soldering, infrared soldering, iron soldering, resistance soldering and torch soldering)	
4. Gas Welding Engineering and Practice		• Describes the principles of gas welding engineering. • Protects self, and the environment from hazardous gases. • Practices safety in a gas welding workshop. • Safely handles gas welding equipment. • Welds in different positions using oxy-acetylene gas welding process. • Performs fusion and non-fusion welding. • Identifies gas welding defects. • Performs gas cutting and gouging. • Perform metal spraying.	• Hazardous gases • Safety practices in a gas welding workshop • Introduction to gas welding engineering • Production and storage of oxygen and acetylene gases • Gas fusion welding • Gas non fusion welding • Gas welding defects • Gas cutting and gouging • Metal spraying	16Hrs
5. Gas Welding, Brazing and Soldering of Non-ferrous Metals		• Identifies filler metals for non-ferrous metals. • Identifies fluxes for non-ferrous metals. • Selects appropriate welding, brazing and	• Welding of aluminium • Welding of copper • Welding of brass	12 Hours

		soldering processes for welding aluminium. • Selects appropriate welding, brazing and soldering processes for welding copper and brass. • Identifies defects in gas welding, brazing, and soldering.	• Gas welding/brazing defects	
6. Brazing		• Prepares work pieces for brazing, soldering and gas welding. • Identifies fluxes used in brazing and metal spraying. • Selects filler metals for brazing, soldering and gas welding. • Assembles joints for dip brazing. • Chooses appropriate type of brazing and soldering. • Performs brazing.	• Introduction to brazing procedures • Fluxes and filler metals • Dip brazing, furnace brazing, induction brazing, infrared, resistance, torch brazing	12Hrs
7. Metal Active Gas (MAG) Welding		• Observes safety precautions when performing MAG welding. • Identifies tools and MAG welding equipment. • Handles and operates MAG welding tools and equipment. • Selects suitable filler materials/electrodes for MAG welding.	Safety considerations when performing MAG welding • Tools and MAG welding equipment and accessories • Principles of operation of MAG equipment • Uses, advantages and disadvantages • Electrodes and shielding gases • MAG welding practice	20Hrs

		• Applies shielding gas during welding. • Prepares work pieces. • Joins work by MAG welding.			
8. Introduction to Powder Metallurgy		• Describes the process of manufacturing powder, compacting and sintering. • Describes the processes of powder metallurgy and state applications. • Identifies products made by powder metallurgy technology and states their uses.	• Powder manufacturing, compacting and sintering • Application of powder metallurgy	4Hrs	
9. Plastic Materials		• Identifies different types of plastics and methods of welding. • Describes characteristics and applications of plastics. • Performs welding of plastics.	• Introduction to plastics • Weldability of plastics	10Hrs	
10. Technical drawing		• Draws objects in 1st and 3rd angle projections. • Interprets objects in first and third angle projections. • Represents correctly and indicates the correct symbol for first and third angle projections. • Interprets and draws views of sectioned objects	• Interpreting and drawing views of objects in 1st and 3rd angle projections • Interpreting and drawing views of sectioned objects in 1st and 3rd angle projections • Principles of isometric and oblique projections,	34Hrs	

		in 1st and 3rd angle projections. • Draws objects in three dimensions.	construction of objects composed of isometric lines and isometric circles • Pictorial drawings interpretation and drawing and 3D drawings • Freehand sketching and drawing and 3D drawings		
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2.1.2 MODULE THREE: WF 1220- STRUCTURAL/PIPE WELDING AND FITTING (HEAVY DUTY)

Training Outcome:

- a) Lay out, fit, and fabricate metal components to assemble structural forms, such as machinery frames, bridge parts, and pressure vessels, using knowledge of welding techniques, metallurgy, and engineering requirements.
- b) Lay out, assemble, install, and maintain pipe systems, pipe supports, and related hydraulic and pneumatic equipment for steam, hot water, heating, cooling, lubricating, sprinkling, and industrial production and processing systems.
- c) Fabricate, lay out, position, align, and fit parts of structural metal products.

Sub-modules	Task	Competences	Syllabus Indicative Content	Duration
1. Safe Working Practices and Environment		• Operates lifting tools and equipment safely. • Observes industrial hygiene. • Identifies and classifies wastes.	• Lifting operations • Types of wastes • Hazardous waste pickup and disposal	4Hrs

		• Safely removes and disposes wastes. • Identifies occupational hazards and eliminates their causes. • Safely picks up and disposes hazardous materials.		
2. Welding Symbols		• Identifies and interprets welding symbols. • Interprets and applies welding symbols.	• Standard welding symbol Basic welding symbols	6Hrs
3. Fabrication Design		• Explains the design process. • Sketches ideas to represent actual needs. • Explains the concept of copying and reverse engineering.	• Introduction to design and the design process Sketching • Interpretation of pictures, sketches and simple drawings • Copying and introduction to reverse engineering theory	10Hrs
4. Blacksmithing		• Identifies and selects forging tools and equipment. • uses forging tools and equipment to bend, draw down, draw out, upset, punch, flatten, twist, cut, scroll and perform swaging and fullering.	• General safety practices in a blacksmith shop Occupational noise Radiation • Forging processes (bending, drawing down, drawing out, upsetting, punching, fullering, flattening, swaging, twisting, cutting and scrolling)	16Hrs

		• Prepares a JSA before doing the job.		
5. Cutting and Sawing		• Practices general safety when performing cutting, sawing, fitting and finishing work. • Selects and identifies hack saw blades for specific jobs. • Cuts material following scribed lines/ dimensions using hacksaws. • Chisels metal stock following scribed lines. • Punches marked surfaces. • Cuts plates using snips, hand shears and power. • Securely fixes a work piece in the machine vice. • Operates drilling machines to drill holes accurately and safely. • Sharpens drill bits to correct angles. • Identifies various types of threads.	• General safety when performing cutting, sawing, fitting and finishing work • Hack sawing • Shearing • Drilling • Thread cutting	20Hrs

		• Performs thread calculations. • Cuts threads using dies and taps.		
6. Sheet Metal Processes		Surface Development • develops surfaces of different objects: rectangular prisms, hexagonal. • draws pyramids, cylinders, truncated cylinders and cones. uses triangulation method of developing surfaces. produces a material usage plan. • marks out surfaces and makes developments of sheet metal patterns and products. • makes working templates and cuts sheet metal. • performs pressing, drawing, shearing, squeezing, bending, punching, edge curling, incurvating, hollowing and raising, roll forming, swaging and levelling of sheet metal	• Material usage plan • Measuring and marking out sheet metal • Patterns and pattern making/drafting • Sheet metal joints • Sheet metal operations (press working processes, drawing, shearing, squeezing, bending, punching, roll forming and spinning operations) • Fabrication of cylinders, boxes, ducts, cones, channel, frustrums from sheet metal	28Hrs
7. Fitting		• Prepares materials for joining.	• Joining (bolting, riveting, bonding, welting)	18 Hours

		- Identifies appropriate methods of joining metals. - Rolls and bends materials. - Straightens and presses materials. - Fits parts according to specifications. - Joins materials using different methods. - Applies the concept of limits and fits. - Assembles and disassembles components.	- Bending and rolling - Surface correction (straightening and pressing) - Interchangeability (limits and fits) - Assembly and disassembly of components	
8. General Maintenance of Machines, Tools and equipment		- Describes breakdown, preventive, periodic and corrective maintenance on machines and equipment. - Performs breakdown, preventive, periodic, predictive and corrective maintenance on machines and equipment.	Introduction to maintenance: breakdown, preventive, periodic, predictive and corrective	4Hrs

9. Metal Inert Gas (MIG) Welding		• Observes safety precautions when performing MIG welding • Identifies tools and MIG welding equipment. • Handles and operates MIG welding machines, uses tools and equipment. • Selects suitable filler materials/electrodes for MIG welding. • Applies shielding gas during welding. • Prepares work pieces. • Joins work by MIG welding.	• Safety considerations when performing MIG welding • Tools and MIG welding equipment • Principles of operation of MIG equipment • Uses, advantages and disadvantages • Electrodes and shielding gases	12Hrs
10. Tungsten Inert Gas (TIG) Welding		• observes safety precautions when performing TIG welding • Identifies tools and TIG welding equipment. • Handles and operates TIG welding tools and equipment. • Selects suitable filler materials/electrodes for TIG welding. • Applies shielding gas during welding.	• Safety considerations when performing TIG welding • Tools and TIG welding equipment • Principles of operation of TIG equipment • Uses, advantages and disadvantages • Electrodes and shielding gases	18Hrs

		• Prepares work pieces. • Joins work by TIG welding.		
11. Welding Pipes and Tubing		• Classifies tubular materials. • Prepares tubular items for welding. • Prepares welding procedures. • Welds pipes and tubing of different materials using different welding processes and techniques. • Observes the safety at the workshop/site for self and machinery.	• Safety practices when welding pipe and tubing • Classification of tubular items • Welding pipes and tubing (mild steel, copper and alloyed pipes, stainless steel and galvanized pipes)	22Hrs
12. Introduction to Vehicle Body Repair and surface Finishing		• Classifies files. • Files flat and curved surfaces. • Grinds surfaces using angle and pedestal grinders. • Identifies different grades of sanding paper. • Sands surfaces to different grades of surface finishes. • Identifies forming tools.	• Safety considerations when performing vehicle body repair and finishing operations • Finishing of surfaces by filing, grinding, sanding, forming, lapping and scrapping	36Hrs

		• Forms metal products using various forming tools and equipment. • Identifies lapping and scraping tools. • Performs lapping and scrapping. • Selects and correctly uses panel beating tools and equipment. • Performs surface preparation and finishing. • Correctly applies adhesives and mechanical fastening on bodies. • Re-aligns deformed areas, applies body fillers and paint or vanishes to the required finish surfaces.	• Equipment and tools for body work • Adhesive bonding • Mechanical fastening (riveting, bolting, welting, clenching) • Body repair • Realignment • Paints • Surface preparation and priming (surface preparation materials, application of fillers, sealants and foundation materials, • refinishing topcoats)	
13. Fabrication of Trusses		• Practices safe truss fabrication. • Applies safety requirements of truss fabrication. • Designs, draws and interprets truss drawings. • Estimates materials for a given or designed truss.	• Safety considerations when performing truss fabrication work • Types of roof trusses (howe, warren, pratt, fink, crescent, fan, cambered, bow-string trusses)	16Hrs

		Fabricates trusses like howe, warren, pratt, fink, crescent, fan, cambered, bow-string trusses.		
14. Steelworks		- Identifies and chooses the appropriate type of connecting parts. - Constructs rivets, bolts and their accessories. - Makes connections by riveting, bolting and welding. - Observes and complies with the safety requirements and standards. - Fabricates structures that make frames for bridges, canopies, rails, bicycles, push carts, trailers and wheelbarrows.	- Safe practices when riveting, bolting and welding frames - Riveted connections - Bolted connections - Pinned connections - Welded connections - Construction of frames of bridges and framed products	14Hrs
15. Fabrication of Jigs and Fixtures		- Safely fabricates and applies jigs and fixtures. - Plans work. - Produces jigs and fixtures. - Controls quality. - Produces complete articles using	- Safety considerations when fabricating and applying jigs and fixtures - Fabrication and application of jigs and fixtures - Mass production (TWP- Training with Production) - Quality control	24Hrs

		different fabrication methods and skills.		
16. Heat Treatment		• Performs heat treatment work safely. • Identifies furnaces. • Anneals, quenches, tempers, hardens and normalizes work.	• Safe handling of heat treatment tools and equipment • Introduction to heat treatment • Heat treatment safety precautions • Types of furnaces and fuels • Annealing • Quenching • Tempering • Hardening • Normalizing	8Hrs
17. Fabrication Sections		• Identifies and correctly selects suitable fabrication sections for given jobs.	• Identification and selection of structural shapes and built-up sections (angle bars, T-sections, channels, I-sections, square tubes, round tubes, Z-sections, flat bars, square bars, round bars, metal sheets and plates)	8Hrs
18. AutoCAD		• Launches AutoCAD on Computer and applies commands • Applies Limits and Tolerances in drawing. • draws machine parts within specified limits	• Applies AutoCAD commands	75Hrs

		• Performs machine drawing. • Draws sections and • Performs draft design		
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2.1.4 MODULE FOUR: WF 2220- WELDING PROCEDURE AND INSPECTION

Training Outcome:

Inspect weldments and welding related activities to ensure that they comply with quality and safety criteria.

Sub-module	Tasks	Competences	Syllabus indicative content	Duration
1. Welding Defects and Remedies		• Practices safety during operations. • Identifies welding defects on joints and their causes. • Classifies welding defects and corrects them. • Sets correct welding parameters and correctly selects welding filler metals.	• Classification of weld defects • Arc welding defects (surface and sub-surface defects) • Corrective action for weld defects	8Hrs
2. Welding Problems, Causes and Remedies		• Describes residual stress, distortion and warpage. • Identifies possible causes of stresses, distortion and warpage. • Devises possible solutions to minimise stresses, distortion and warpage. • Identifies weld stresses, cracks and makes corrections.	• Residual stresses • Distortion and warpage • Weld stresses and cracking • Remedies of welding problems	8Hrs

3. Weld Inspection and Tests		• practices safety precautions when performing destructive testing (DT), non-destructive testing (NDT) and pressure leak tests. • Differentiates between destructive and non-destructive testing. • Selects appropriate weld inspection and testing method. • Performs: tensile, fatigue, guided bend, fillet weld-break, etching and impact test. • Performs visual, radiographic, ultrasonic, eddy current inspections and dye penetrant, magnetic particle tests. • Performs pressure and leak tests. • Determines appropriate weld testing methods for given tasks. • Applies destructive, non-destructive and pressure leak testing methods to test welds.	• Safety considerations when performing DT, NDT and pressure leak tests • Introduction to quality control • Destructive tests • Non-destructive tests • Pressure and leak tests	20Hrs
4. Welding Procedure		• Observes safety when testing welds. • Describes types of welding procedures. • Welds following specified welding procedures. • Tests welds following welder qualification standards.	• Introduction to welding procedure (welding codes and specifications) • Procedure specification • Procedure qualification • Welder qualification	22Hrs
6. Finishing Work		• Describes different metal finishing methods. • Grinds, files, polishes and coats fabricated work.	• Grinding, filing, polishing, coating (painting, spray painting,	4Hrs

			galvanizing and electroplating)	
7. Introduction to Failure and Deformation of Metals		- Determines stress, strain, tension and compression of materials. - Relates stress, strain, tension and compression to failure and deformation of materials. - Identifies the causes of ductile and brittle failures and how it affects fabrication of materials. - Describes behaviour of materials under ductile and brittle failure.	- Stress and strain - Tension and compression: direct stress - Ductile failure - Brittle failure	10Hrs
8. Weld Costing. Estimation, and Costing of Labour and Materials		- Estimates costs of production (materials, labour and utilities). - Costs for labour required in doing the planned and work at hand. - Calculates overheads and depreciation of tools and equipment.	- Weld cost elements - Weld metal (filler metal) and material requirements - Welding power and gas overhead costs - Time and labour requirement - Taxes (VAT, local government taxes, PAYE, income tax) - Material estimation and costing - Labour costs - Overheads and depreciation of equipment	20Hrs
9. AutoCAD		- Identifies and uses the CAD tool bars. - Produces drawings using CAD.		37Hrs

		• Plots the drawings to paper (printing). • Makes the drawing sheet and title block. • Dimensions the drawings. • Writes text on the drawings. • Rotates, hatches, moves, copies, pastes and deletes objects.		
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