



DELTA STATE JOB AND WEALTH CREATION BUREAU

Governor's Office, Asaba.

WELDING AND FABRICATION TRAINING MANUAL

DURATION: 9 MONTHS

WEEK	DAY	TASKS	ACTIVITIES (SPECIFIC ACTIONS)	METHOD
1	1	Introduction to welding and fabrication	The instructor will introduce the trainees to the concept of welding and fabrication.	Instruction
	2	Safety precaution	The instructor will teach the trainees the concept of safety practice in a welding workshop.	Instruction
	3		The instructor will teach the trainees the sources of hazards in the workshop and how to prevent them.	Instruction
	4		The instructor will teach the trainees: I. The handling and uses of hand tools II. Portable power tools and machines.	Practice
	5		The instructor will teach the trainees how to clear debris and wastages.	Practice
2	1	Safety precaution (cont'd)	The instructor will teach the trainees lifting, moving and storing materials for jobs.	Practice
	2-3		The instructor will teach the trainees how to use inflammable or corrosive liquids and gases.	Practice
	4		The instructor will teach the trainees how to avoid inhaling vapour or fumes.	Practice
	5	Safety in the workshop	The instructor will teach the trainees how to lift, move and store materials for jobs.	Practice
3	1	Safety in the workshop (safety rules)	The instructor will teach the trainees proper safety clothing, health hazards and general workshop hygiene.	Practice

		and regulations)		
	2	Safety in the workshop	The instructor will teach the trainees proper ethics of material handling, movement and other behaviour of workers in workshop.	Practice
	3		The instructor will teach the trainees tools handling, storage and usage.	Practice
	4-5	Safety in the workshop	The instructor will teach the trainees machine operation and fire prevention.	Practice
4	1-5	Metals and properties	The instructor will teach the trainees the meaning of the following physical properties of metals: I. Difficulty II. Malleability III. Strength IV. Toughness V. Brittleness VI. Elasticity VII. Plasticity.	Instruction & practice
5	1	Measurements, cutting and striking tools	The instructor will teach the trainees the importance of measurement in welding: know the difference between line and end measurement.	Instruction
	2		The instructor will teach the trainees the importance of measurement in welding: use of datum points, datum lines and datum faces in marking out.	Practice
	3		The instructor will teach the trainees the importance of measurement in welding: describing the functions and application of instruments used in metal work.	Practice
	4		The instructor will teach the trainees the importance of measurement in welding: steel rule, dividers, calipers (inside, outside and odd legs), trammel scribe angle plate, centre square.	Practice
	5		The instructor will teach the trainees the various types of file, stating their grades and applications.	Instruction
6	1	Measurements, cutting and striking tools	The instructor will teach the trainees the various types of files: identify the flat, square, round, half, tee-square, warding polar, mill and rasp.	Instruction & practice
	2		The instructor will teach the trainees how to classify the common files used	Practice

			in metal works and state the composition of materials used for their manufacture.	
	3-5		The instructor will teach the trainees how to sketch the bench vice, explain its clamping power and demonstrate the techniques of holding work in the vice for filing, tapping, designing and operation.	Practice
7	1	Oxyacetylene cutting and gas welding equipment	The instructor will teach the trainees how to differentiate between the following types of generators stating their merits and demerits: I. Water to carbide generator II. Carbide to water generator and III. Purifier.	Instruction & practice
	2		The instructor will teach the trainees the composition of calcium carbide generator.	Instruction & practice
	3		The instructor will teach the trainees how to identify the following flames and describe how they are derived in the oxyacetylene welding processes: oxidizing flame, carbonizing flame and neutral flame.	Instruction & practice
	4		The instructor will teach the trainees how to identify the following flames and describe how they are derived in the oxy-acetylene welding processes: I. Oxidizing flame II. Carbonizing flame and III. Neutral flame.	Instruction & practice
	5		The instructor will teach the trainees the instances of the application/uses of the types of flames.	Instruction & practice
8	1	General metal work	The instructor will teach the trainees the general characteristic of materials used in fabrication and welding engineering including simple consideration of physical properties such as: I. Strength II. Ductility III. Malleability IV. Hardness V. Tenacity VI. Fusion	Instruction & practice
	2			Instruction & practice
	3			Instruction & practice

			<p>VII. Distortion</p> <p>VIII. Toughness and resistance to impact</p> <p>In relation to uses and common manufacturing processes and weldability of materials.</p>	
	4-5		The instructor will teach the trainees the common fabrication engineering use of cast iron, mild steel, high yield steel and cast.	Instruction & practice
9	1-3	General metal work	The instructor will teach the trainees steel austenite, stainless steel, copper and common copper, alloys, aluminum and common aluminum alloys, common forms or supply and general limitations of cast forms. The instructor will also teach the properties and common composition of fluxes used for welding nonferrous metals.	Instruction & practice
	4-5		The instructor will enumerate and teach the two functions of fluxes in the welding of nonferrous metals.	Instruction & practice
10	1	Structural steel work	The instructor will teach the trainees the safety rules as applicable to structural steel works.	Instruction & practice
	2		The instructor will teach the trainees the basic processes of manufacturing iron and steel.	Instruction & practice
	3		The instructor will teach the trainees how to use and care for tools and equipment used in structural steel work.	Instruction & practice
	4-5		The instructor will teach the trainees the structural properties of materials used in structural steel work and make simple calculations related to their strength.	Instruction & practice
11	1	Structural steel work	The instructor will teach the trainees how to produce simple structural steel projects on the floor.	Instruction & practice
	2		The instructor will teach the trainees how to assemble simple structural steel components.	Instruction & practice
	3		The instructor will teach the trainees the effect of corrosion on structural steel material and how to apply to protective coating against it.	Instruction & practice

	4		The instructor will teach the trainees with sketches the following forms of structural steel materials e.g. plates (various thickness), universal channel, universal beam, rolled steel joist, T-bar, angle bar, check plates (assorted), bridge beam.	Instruction & practice
	5		The instructor will teach the trainees how to interpret conventional symbols and abbreviations used to represent structural steel sections.	Instruction & practice

12	1	Fabrication tools	The instructor will describe to the trainees the use of the following tools: I. Cold chisels (flat, cross, cut half round, diamond-point) II. Centre punch and dot punch III. Scrappers (flat, triangular, half round)and IV. Power hacksaw.	Instruction & practice
	2		The instructor will describe to the trainees various parts of hacksaw and their functions.	Instruction & practice
	3		The instructor will describe to the trainee the common types of hacksaw blades, their range of pitches and their application.	Instruction & practice
	4-5		The instructor will teach the trainees the safety precautions to be observed when using the hand hacksaw.	Instruction & practice
13	1-5	Technical drawing/ measurement	The instructor will teach the trainees structural drawing with use of technical drawing equipment.	Instruction & practice
14	1	Sheet metal work	The instructor will teach the trainees the meaning of the following terms: I. Edge stiffing II. beading and III. Work hardening.	Practice
	2		The instructor will teach the trainees the meaning of the following terms: I. Beating II. Annealing III. Hardening.	Practice

	3		The instructor will teach the trainees the meaning of following terms: raising, planishing and sand blasting.	Practice
	4		The instructor will teach the trainees the meaning of the following terms: I. Lacquering II. Galvanizing III. Painting.	Practice
	5		The instructor will teach the trainees the mechanical properties of sheet metals.	Practice
15	1	Sheet metal (understanding the principles of fabrication)	The instructor will teach the trainees the principles of fabricating baking oven.	Practice
	2		The instructor will teach the trainees the principles of fabricating gates.	Practice
	3		The instructor will teach the trainees the principles of fabricating metal doors.	Practice
	4		The instructor will teach the trainees the principles of fabricating sign posts.	Practice
	5		The instructor will teach the trainees the principles of fabricating burglary proofs.	Practice
16	1	Electrode	The instructor will teach the trainees the types of electrodes and their gauges (classification).	Instruction
	2	Electrode	The instructor will teach the trainees the composition of electrode coating.	Instruction
	3	Electrode	The instructor will teach the trainees the types of electrodes used for specific welding.	Practice
	4	Electrode	The instructor will teach the trainees how to fix and use electrodes.	Practice
	5	Electrode	The instructor will teach the trainees how to fix and use electrodes.	Practice
17	1	Arc welding	The instructor will teach the trainees how to apply safety precaution related to metal arc welding.	Instruction & practice
	2	Arc welding	The instructor will teach the trainees the features and working principle of arc welding machines and accessories.	Instruction & practice
	3	Arc welding	The instructor will teach the trainees how to make different types of welding joint in all position.	Instruction & practice

	4	Arc welding	The instructor will teach the trainees the properties of various types of ferrous and nonferrous metals.	Instruction & practice
	5		The instructor will teach the trainees how to build metallic shafts and surfaces using metal arc welding.	Practice
18	1-2	Arc welding	The instructor will teach the trainees how to build metallic shafts and surfaces using metal arc welding.	Practice
	3-5		The instructor will teach the trainees how to cut metals of various specifications using metal arc cutting process.	Practice
19	1-2	Gas welding	The instructor will teach the trainees how to apply the general safety precaution related to gas welding. The instructor will also teach the trainees how to successfully apply various gas welding processes/ operations including the oxyfuel gas cutting process.	Practice
	3-4		The instructor will teach the trainees the process of building up metallic shafts or surfaces.	Practice
	5		The instructor will teach the trainees how to apply the general safety precaution related to gas welding	Practice
20	1	Gas welding	The instructor will teach the trainees the basic welding defects and how to rectify them	Instruction & practice
	2-3		The instructor will teach the trainees the application of iron and alloy steel in the engineering industry e.g. steel: plain, carbon steel, dead mild steel, mild steel, medium carbon steel and high carbon steel.	Instruction & practice
	4		The instructor will teach the trainees the different types of iron: cast iron, gray cast iron, malleable cast iron, iron carbide, alloy cast iron (spherical and acicular).	Practice
	5		The instructor will teach the trainees the different alloy steels: I. High speed steel II. High tensile steels III. Tungsten	Practice

			IV. stainless steels satellite	
21	1	Principle of drilling machine and its application	The instructor will teach the trainees the various types of drilling machine	Instruction & practice
	2		The instructor will describe with sketches to the trainees the main features of a bench or pillar drilling machines.	Instruction & practice
	3-5		The instructor will describe with sketches and state where each of the following types of drill is best suited: I. Twist drill (taper shank, parallel shank and jobbers drill and their relative merits) II. Flat drill III. Counter sink drill IV. Counter drill V. Combination centre drill.	Instruction & practice
22	1-2	Principle of drilling machine and its application	The instructor will explain the effects of the following faults in a ground twist drill bit: I. Point angle too acute II. Point angle too obtuse III. Cutting edges at unequal angles IV. insufficient lip clearance V. Excessive lip clearance	Instruction & practice
	3-5		The instructor will teach the trainees how to calculate the spindle revolution or cutting speed for specified sizes of drill using the formulae: $N = 1000s/n$ $S = \pi dn/1000$ Where s= cutting speed (m/min); n=revolution/minutes; D=diameter of drill (mm) and $\Pi=3.142$	Instruction & practice
23	1-2	Principles of drilling machine and their application	The instructor will teach the trainees the causes and remedy of drilling faults such as: drilling breaking, drill coloured blue, walls of frilled hole left rough, chipped cutting lips.	Instruction & practice
	3		The instructor will teach the trainees the safety precautions to be observed when using a drilling machine.	Instruction & practice
	4-5		The instructor will teach the trainees the purpose of reaming and describe	Instruction & practice

			different types of hand machine reamer.	
24	1-5	Engineering components bench production	The instructor will teach the trainees the layout procedures from working drawings of simple engineering components or tools such as: open ended spanner, engineers tri-square, tools that makes up a tri- square, plate bracket or gusset (involving round angles, holes), centre square.	Instruction & practice
25	1-2	Engineering components bench production	The instructor will teach the trainees how to produce any simple engineering component to given specification including dimensions, tolerance and finish.	Instruction & practice
	3-5		The instructor will teach the trainees how to carry out simple precision fitting projects e.g. hexagonal mild steel bar making push fit through a mild steel plate.	Instruction & practice
26	1-3	Welding defects	The instructor will describe to the trainees the major defects in arc welded joints including undercut, lack of fusion porosity, slag inclusion and unequal leg length.	Instruction & practice
	4-5		The instructor will teach the trainees how weld defects can be avoided.	Instruction & practice
27	1-5	Simple structural steel component	The instructor will teach the trainees the uses of fixtures and bolt in the assembly of structural components e.g. bolt reverting and welding.	Instruction & practice
28	1-3	Corrosion in steel	The instructor will teach the trainees the common causes of corrosion on steel, e.g. atmospheric; chemical (electrolytes action).	Instruction & practice
	4-5		The instructor will teach the trainees the effect of corrosion on structural steel e.g. weakening of structure and defacing of steel.	Instruction & practice
29	1	Corrosion in steel	The instructor will teach the trainees the purpose for applying undercoat to structural steel components.	Instruction & practice
	2		The instructor will teach the trainees the composition of common undercoat used for structural work.	Instruction & practice

	3-5		The instructor will teach the trainees how to apply the undercoat to structure steel components.	Practice
30	1-3	Introduction to folding machine	The instructor will teach the trainees how to corrugate sheet metals to various shapes: main gate, doors, and roofing sheets.	Instruction & practice
	4-5	Mark out	The instructor will teach the trainees how to mark out a design on a steel plate.	Instruction & practice
31	1-2	Riveting	The instructor will teach the trainees how to practice with pop rivet.	Instruction & practice
	3-5		The instructor will teach the trainees how to rivet thick plates with one-quarter ($\frac{1}{4}$) rod.	Instruction & practice
32	1-2	Welding transformer	The instructor will teach the trainees the working principles of transformer	Instruction & practice
	3-4	Quotations	The instructor will teach the trainees how to carry out quotations for projects.	Instruction & practice
	5	Review	The instructor will lead the trainees in a review of all the activities of the months so far.	Discussion
33	1-5	Revision	Revise all that have been learnt.	Instruction & practice
34	1-5	Project	The trainees will carry out a project on fabrication using arc welding at group and individual levels.	Practice
35	1-5	Project	The trainees will carry out a project on fabrication using gas welding (oxyacetylene) at group and individual levels.	Practice
36	1-2	Conclusion of projects	All projects must be completed.	
	3-5	Review	The instructor will lead the trainees in a review of all the activities.	Discussion