Government of Pakistan

National Vocational and Technical Training Commission

Prime Minister Hunarmand Pakistan Program

"Skills for All"

Course Contents/ Lesson Plan

Course Title: Electric Arc Welding

Duration: 6 Months

Trainer Name	
Course Title	**Electric Arc Welding**
Objective of Course	**Employable skills and hands on practice for Electric Arc Welding** The aim for the team of staff responsible for delivery of the electric arc welding curriculum is to provide knowledge and develop skills related to the welding. The course will allow participants to gain a comprehensive understanding of all the aspects. It will also develop the participant's ability to act in a professional and responsible manner. Teaching staff will provide the technical knowledge and abilities required to solve tasks and problems that are goal-oriented. They will use participant-centered, practically oriented methods. They will also develop a program of practical assessment that reflects the learning outcomes stated in the curriculum. Trainees of the electric arc welding curriculum will also develop their willingness and ability as individuals to clarify issues, as well as think through and assess development opportunities. Teaching staff will also support trainees in developing characteristics such as self-reliance, reliability, responsibility, a sense of duty and a willingness and ability to criticize and accept criticism well and to adapt their future behavior accordingly. Teaching staff also use the welding curriculum to address the development of professional competence. Trainees will acquire the ability to work in a professional environment. The purpose of these qualifications is to set high professional standards for welder's job. These national qualifications will support training providers in enhancing the quality of training and assessment in Pakistan. The specific objectives of developing these qualifications are as under: • Improve the overall quality of training delivery and setting national benchmarks for training of welders in the country. • Provide flexible pathways and progressions to learners enabling them to receive relevant, up-to-date and recent skills. • Provide basis for competency-based assessment which is recognized and accepted by employers. • Establish a standardized and sustainable system of training for welders in the country

Learning Outcome of the Course	By the end of this course, the trainees should gain the following competencies: • Maintain Safe Work Environment • Prepare Materials for Welding • Use Shielded Metal Arc Welding (SMAW) in Flat (1F, 1G) position • Use advance welding techniques at Horizontal (2F, 2G) Positions Using SMAW Process. • Use advance welding techniques at vertical (3F, 3G) Positions Using SMAW Process. • Use Gas Metal Arc Welding (GMAW) in Flat (1F, 1G) position. • Use advance welding techniques at Horizontal (2F, 2G) Positions using Gas Metal Arc Welding. • Carry out Advance(Flux Cored Arc) Welding (FCAW) in Flat (1F, 1G) and Horizontal (2F, 2G) Positions • Use advance Gas Tungsten Arc Welding (GTAW) in Flat (1F, 1G) and Horizontal (2F, 2G) Positions
Course Execution Plan	Total Duration of Course: **6 Months (26 Weeks)**
	Class Hours: **4 Hours per day**
	Theory: **20% Practical: 80%**
	Weekly Hours: **25 Hours Per week**
	Total Contact Hours: **600 Hours**
Companies Offering Jobs in the respective trade	1. Automotive industries 2. Automotive parts producing vendor 3. Oil and Gas industries 4. Power plants 5. Processing industries 6. Ship making industries 7. Construction industries 8. Oil refineries

Job Opportunities	All over the world there is a high demand in the Welding industry for Welders in various field Such as: fabricators, pipe welders, multi-welders, constructors. With the help of this course, we will be able to give technical trainings of Advance welding to our youth. There are also opportunities for start-up entrepreneurship due to the high demand in the market in following designated jobs; • Fitters • Fabricators • 3G welders • Argon welders • CO2 Welders • Multi welders • Structural Contractors • Welding supervisors • Welding inspectors with additional quality inspection training.
No of Students	25 Morning 25 Evening
Learning Place	Classroom / Workshop
Instructional Resources	

Course Outline:

Scheduled Week	Module Title	Days	Learning Units	Remarks
Week 1	➢ Introduction	1	Motivational Lecture Course Introduction	
		2	Success stories Job market	
		3	Course Applications Institute/work ethics	
		4	Introduction of welding Various welding processes Welding Hazards and safety	
		5	Personnel protective Equipment (PPEs) Setting SMAW equipment Starting welding	
Week 2	**<u>Module -1</u> Shielded Metal Arc Welding (SMAW)** **Chapter 1** Maintain welding workshop safety and set equipment for SMAW.	1	Hazard at workplace Safety Signs	
		2	Welding Equipment Welding transformer	
		3	Welding cable Return cable	
		4	Electrode holder Preparation material for welding	
		5	Setting welding current Welding Bead Practice	
Week 3	**Chapter 2** Shielded Metal Arc welding (SMAW) At 1F position	1	Basic measuring tools Electrode Number	
		2	Welding Current Electrode manipulation	
		3	Preparing material for flat 1F position Tack weld	
		4-5	Electrode angle (slop angle) Practice welding at 1F	
Week 4	**Chapter 2 Continued**	1	Metal and non- Metal	
		2	Material Identification by color	
		3	Basic Workshop tools	
		4-5	Practice welding at 1F position	
Week 5	**Chapter 3:** Shielded Metal Arc	1-2	Welding Positions Types of weld AWS position codes	

	welding (SMAW) At 1G position	3-5	Types of grooves Root face Root gape Including angle Root pass Filling pass Capping Penetration Welding practice at 1G position	
Week 6	**Chapter 4** Shielded Metal Arc welding (SMAW) At 2F position	1	Weld features Leg length	
		2	Throat Convex face	
		3	Concave face Mitered face	
		4	Perpendicularity Setting current	
		5	Electrode tilt slop angle while welding Welding at 2F position	
Week 7	**Chapter 6** Shielded Metal Arc welding (SMAW) At 2G position	1	Material Properties (Mechanical)	
		2	Material Preparation Beveled angle	
		3	Root face Root gape setting	
		4-5	Electrode manipulation Welding at 2G position	
Week 8	**Chapter 7** Shielded Metal Arc welding (SMAW) At 3F / 3G position	1	Material Preparation Setting work piece vertical position	
		2	Electrode angle Electrode manipulation	
		3-4	Welding at 3F /3G position Cleaning of bead	
		5	Visual inspection	
Week 9	**Module 2** **Gas Metal Arc Welding** **Chapter 1** Setting equipment	1	Function of Shielding gases Active gases	
		2	Inert gases Gas regulator Need of heater	
		3	Cracking cylinder Attaching cylinder to machine	
		4	Installing wire spool Attaching torch to machine	
		5	Setting parameter Inching Starting welding	

Week 10	**Chapter 2** Gas Metal Arc Welding at 1F position	1	Preparing Material Tack weld	
		2-3	Set work piece as per 1F position Torch angle	
		4-5	Wire manipulation Welding at 1F position	
Week 11	**Chapter 3** Gas Metal Arc Welding at 1G position	1	Welding defects identification Material Preparation	
		2-3	Setting root gap Gas flow	
		4-5	Setting parameter Tack weld Welding at 1G position	
Week 12	**Chapter 4** Gas Metal Arc Welding at 2F position	1	Material Preparation Tack weld	
		2-3	Position material Gas flow	
		4-5	Setting parameter Wire manipulation Welding at 2F position	
Week 13	**Chapter 5** Gas Metal Arc Welding at 2G position	1	Preparing material Tack weld	
		2-3	Position material Setting parameter	
		4-5	Wire manipulation Welding at 2G position	
Week 14	**Module 3**	**1**	Introduction to process	
		2	Process Application Flux core wire construction	
		3	Shielding methods FCAW machine parts	
		4	External unit Loading wire spool	
		5	Roller Pressure setting Wire inching Parameter setting Starting welding	
Week 15	MID-TERM EXAM			
Week 16	**Chapter2** FCAW welding at 1F Position	1	Material Preparation Setting current	
		2	Setting voltage Selecting shielding	
		3	Selecting wire diameter Positioning material	
		4	Setting torch angle	

			Wire manipulation	
		5	Welding at 1F positions	
Week 17	Chapter 3 FCAW welding at 1G Position	1	Material Preparation Setting current	
		2	Setting voltage Selecting shielding	
		3	Selecting wire diameter Positioning material	
		4	Setting torch angle Wire manipulation	
		5	Welding at 1G positions	
Week 18	Chapter 4 FCAW welding at 2F Position	1	Material Preparation Setting current	
		2	Setting voltage Selecting shielding	
		3	Selecting wire diameter Positioning material	
		4	Setting torch angle Wire manipulation	
		5	Welding at 2F positions	
Week 19	Chapter 5 FCAW welding at 2G Position	1	Material Preparation Setting current	
		2	Setting voltage Selecting shielding	
		3	Selecting wire diameter Positioning material	
		4	Setting torch angle Wire manipulation	
		5	Welding at 1G positions	
Week 20	**Module 4** Gas Tungsten Arc Welding (GTAW) **Chapter 1** Setting equipment	1	Types of Electrode Shielding Gases Electrode sharpening	
		2	Ceramic cup Collets Gas diffuser Air or water cooled welding torches	
		3	Attaching torch to machine Attaching cylinder to machine Setting gas flow	
		4	Setting electrode in torch Setting start current Up-Slop time	
		5	Welding base time Down-slop time Setting Cater filler Start welding	
Week 21	On job training in parallel with short		On job training: Aims to provide industrial training to the	

	course		Trainees as part of overall training program Ideal for the manufacturing trades As an alternate to the projects that involve expensive equipment Focuses on increasing Trainee's motivation, productivity, efficiency and quick learning approach in parallel with short course.	
Week 22	**Chapter 2** GTAW at 1F position	**1**	Material Preparation	
		2	Setting parameter Tack weld	
		3	Fore-hand technique Back-hand technique	
		4	Electrode manipulation Wire feeding	
		5	Welding at position	
Week 23	**Chapter 3** GTAW at 1G position	**1**	Material Preparation	
		2	Setting parameter Tack weld	
		3	Fore-hand technique Back-hand technique	
		4	Electrode manipulation Wire feeding	
		5	Welding at 1G position	
Week 24	**Chapter 4** GTAW at 2F position	**1**	Material Preparation Setting parameter	
		2-3	Tack weld Electrode manipulation Wire feeding	
		4-5	Welding at 2F position	
Week 25	**Chapter 5** GTAW at 2G position	**1**	Preparing material Setting parameter	
		2-3	Tack weld Electrode manipulation Wire feeding	
		4-5	Welding at 2G position	
Week 26	Entrepreneurship	1-4	Job Market Searching Self-employment Business Incubation and Acceleration	
	Final Assessment	5	FINAL EXAM	

List of Machinery / Equipment

Sr. No	Name of item as per curriculum	Quantity physically available at the training location
1	Welding Machines: • Shielded Metal Arc Welding Machine • Gas Metal Arc Welding Machine • Flux core Arc Welding Machine • Gas Tungsten Arc Welding Machine	03 machines each
2	Measuring tools: • Steel rule • Vernier caliper • Measuring tape • Try square • Beveled protector	
3	Basic workshop tools: • Scriber • Center punch • Hammer • Hand grinder • Files • Chisel • File brush • Power cutter • Hacksaw frame • Welding tong • Chipping hammer • Wire brush	Available on every PC
4	**Personnel protecting equipment (PPEs):** • Welding hand shield • Welding helmet • Safety goggle • Ear plugs • Gas Mask • Leather apron • Leather gloves • Spats • Safety shoes	25 each

5	**Consumables:** • MS plate 150 x 50mm thickness 6 to 10 mm. • MS plate 150 x 50 x 3 mm • Grinding disc dia4” • Cutting disc dia 14”	For every PC

Minimum Qualification of Teachers / Instructor

The qualification of teachers / instructor of this course should be minimum DAE in Mechanical **with minimum 3 years of experience** in relevant trade.