

## Syllabus for the post of Workman Trainee Welder (Total 100 marks)

### PART – A (80 Marks)

#### Welder Theory

- Importance of trade Training. - General discipline in the Institute - Elementary First Aid. - Importance of Welding in Industry - Safety precautions in Shielded Metal Arc Welding, and Oxyacetylene Welding and Cutting.
- Introduction and definition of welding. - Arc and Gas Welding Equipment's, tools and accessories. - Various Welding Processes and its applications. - Arc and Gas Welding terms and definitions. Different process of metal joining methods: Bolting, riveting, soldering, brazing, seaming etc. - Types of welding joints and its applications. Edge preparation and fit up for different thickness. - Surface Cleaning.
- Basic electricity applicable to arc welding and related electrical terms & definitions. - Heat and temperature and its terms related to welding - Principle of arc welding. And characteristics of arc.
- Common gases used for welding & cutting, flame temperatures and uses. - Chemistry of oxy-acetylene flame. - Types of oxy-acetylene flames and uses. - Oxy-Acetylene Cutting Equipment principle, parameters and application.
- Arc welding power sources: Transformer, Motor Generator set, Rectifier and Inverter type welding machines and its care & maintenance. - Advantages and disadvantages of A.C. and D.C. welding machines
- Welding positions as per EN & ASME: flat, horizontal, vertical and overhead position. - Weld slope and rotation. - Welding symbols as per BIS & AWS.
- Arc length – types – effects of arc length. - Polarity: Types and applications. - Weld quality inspection, common welding mistakes and appearance of good and defective welds - Weld gauges & its uses.
- Calcium carbide properties and uses. - Acetylene gas properties and generating methods. - Acetylene gas Purifier, Hydraulic back pressure valve and Flash back arrestor
- Oxygen gas and its properties - Production of oxygen by Air liquefaction. - Charging process of oxygen and acetylene gases - Oxygen and Dissolved Acetylene gas cylinders and Color coding for different gas cylinders. - Gas regulators, types and uses.
- Oxy acetylene gas welding Systems (Low pressure and High pressure). Difference between gas welding blow pipe (LP & HP) and gas cutting blow pipe - Gas welding techniques. Rightward and Leftward techniques. Arc blow – causes and methods of controlling. - Distortion in arc & gas welding and methods employed to minimize distortion - Arc Welding defects, causes and Remedies.
- Specification of pipes, various types of pipe joints, pipe welding all positions, and procedure. - Difference between pipe welding and plate welding.
- Pipe development for Elbow joint, "T" joint, Y joint and branch joint - Manifold system
- Gas welding filler rods, specifications and sizes. - Gas welding fluxes – types and functions. - Gas Brazing & Soldering: principles, types fluxes & uses - Gas welding defects, causes and remedies.
- Electrode: types, functions of flux, coating factor, sizes of electrode Coding of electrode as per BIS, AWS, - Effects of moisture pick up. - Storage and baking of electrodes.
- Special purpose electrodes and their applications. Weldability of metals, importance of pre-heating, post heating and maintenance of inter pass temperature. Classification of steel. - Welding of low, medium and high carbon steel and alloy steels.

- Effects of alloying elements on steel - Stainless steel types- weld decay and weldability.
  - Brass – types – properties and welding methods. - Copper – types – properties and welding methods. Aluminum and its alloys, properties and weldability, Welding methods - Arc cutting & gouging, Cast iron and its properties types. - Welding methods of cast iron.
- Types of Inspection methods - Classification of destructive and NDT methods - Welding economics and Cost estimation.
- Safety precautions in Gas Metal Arc Welding and Gas Tungsten Arc welding. - Introduction to GMAW - equipment – accessories. - Various other names of the process. (MIG/MAG/CO2 welding.) - Modes of metal transfer – dip or short-circuiting transfer, spray transfer (free flight transfer) and globular transfer (intermittent transfer) and Pulsed metal transfer. Wire feed system – types – care and maintenance. - Welding wires used in GMAW, standard diameter and codification as per AWS. - Types of shielding gases and gas mixtures used in GMAW and its applications. - Flux cored arc welding – description, advantage, welding wires, coding as per AWS. - Heat input and techniques of controlling heat input during welding. - Heat distribution and effect of faster cooling.
- Pre-heating & Post Weld Heat Treatment - Use of temperature indicating crayons.
- Submerged arc welding process –principles, equipment, advantages and limitations.
- Electro slag and Electro gas welding processes–principles, equipment's, advantages and limitations. Thermit welding process- types, principles, equipment's, Thermit mixture types and applications. - Use of backing strips and backing bars.
- GTAW process - brief description. Difference between AC and DC welding, equipment's, polarities and applications. - Various other names of the process (TIG, Argon arc) - Power sources for GTAW - AC &DC
- Tungsten electrodes –types & uses, sizes and preparation - GTAW Torches- types, parts and their functions - GTAW filler rods and selection criteria.
- Edge preparation and fit up. - GTAW parameters for welding of different thickness of metals - Pulsed TIG welding - brief description, pulse parameters slope up and slope down.
- Friction welding process equipment and application - Laser beam welding (LBW)and Electron beam welding (EBW) - Plasma Arc Welding (PAW) and cutting (PAC) process – equipment's and principles of operation. - Types of Plasma arc, advantages and applications.
- Resistance welding process -types, principles, power sources and welding parameters. - Applications and limitations.
- Metalizing – types of metalizing principles. - Manual Oxy – acetylene powder coating process principles of operation and applications. - Reading of assembly drawing - Welding Procedure Specification (WPS) and Procedure Qualification Record ( PQR).
- Hard facing/ surfacing necessity, surface preparation, various hard facing alloys and advantages of hard facing. - Plastic welding machine with hot air gun and plastic material: Polypropylene (PP) Polyethylene (PE) Polyvinylchloride (PVC).

## **Engineering Drawing**

- Introduction to Engineering Drawing and Drawing Instruments; Conventions Sizes and layout of drawing sheets Title Block, its position and content Drawing Instrument - Free hand drawing of; Geometrical figures and blocks with dimension Transferring

measurement from the given object to the free hand sketches. Free hand drawing of hand tools and measuring tools. - Lines Types and applications in drawing -Drawing of Geometrical figures; Angle, Triangle, Circle, Rectangle, Square, Parallelogram. Lettering & Numbering – Single Stroke, double stroke, inclined - Reading of dimension and Dimensioning Practice. - Reading of fabrication drawing, sectional view of different types of welding Joints. Sectional view of different pipe joints - Symbolic representation different symbols used in the related trades Reading of Job Drawing of related trades.

### **Workshop calculation and Science**

- Unit, Fractions - Square root, Ratio and Proportions, Percentage - Material Science - Mass, Weight, Volume and Density -Heat & Temperature and Pressure - Basic Electricity - Mensuration – Trigonometry

### **PART-B (20 marks)**

- Logical Reasoning (5 questions),
- Quantitative Aptitude (5 questions),
- English (5 questions)
- General Knowledge/ Awareness (5 questions)