

Syllabus for the Post of Junior Technician (Welding)-Level A1

Essential Qualification: High School or Class X Equivalent Board Examinations with Science and Trade Certificate in Welding.

Part (A): General Mental Ability and Aptitude	20% (20 questions carrying 1 mark each)
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General Mental Ability and Aptitude to test the following:

- Interpersonal Skills
- Logical reasoning/Analytical/Comprehension ability
- Basic Numeracy and Data Interpretation Skills
- General Awareness

Part (B): Subject/Domain Related	80 % (80 questions carrying 1 mark each)
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1. 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 Oxy; Acetylene Welding and Cutting; Introduction and definition of welding ; Arc and Gas Welding Equipments, tools and accessories; Various Welding Processes and its applications. Arc and Gas Welding terms and definitions.
2. 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
3. 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.
4. 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.
5. 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
6. Calcium carbide properties and uses. Acetylene gas properties and generating methods. Acetylene gas Purifier, Hydraulic back pressure valve and Flash back arrestor.
7. 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.
8. 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.
9. Arc blow – causes and methods of controlling. Distortion in arc & gas welding and methods employed to

minimize distortion. Arc Welding defects, causes and Remedies

10. 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 .
11. 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
12. Electrode : types, functions of flux, coating factor, sizes of electrode Coding of electrode as per BIS, AWS; Effects of moisture pickup. Storage and baking of electrodes. Special purpose electrodes and their applications
13. Weldability of metals, importance of pre heating, post heating and maintenance of inter pass temperature.
14. 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
15. Brass – types – properties and welding methods. Copper – types – properties and welding methods.
16. Aluminium and its alloys, properties and weldability, Welding methods. Arc cutting & gouging,
17. Cast iron and its properties types. Welding methods of cast iron.
18. Types of Inspection methods. Classification of destructive and NDT methods. Welding economics and Cost estimation.
19. 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.). Advantages of GMAW welding over SMAW, limitations and applications. Process variables of GMAW. Modes of metal transfer – dip or short circuiting transfer, spray transfer (free flight transfer) and globula transfer (intermittent transfer) and Pulsed metal transfer.
20. Wire feed system – types– care and maintenance. Welding wires used in GMAW, standard diameter and codification as per AWS.
21. 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. Edge preparation of various thicknesses of metals for GMAW. GMAW defects, causes and remedies
22. 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.
23. Submerged arc welding process –principles, equipment, advantages and limitations. Electro slag and Electro gas welding processes– principles, equipments, advantages and limitations.
24. Thermit welding process; types, principles, equipments, Thermit mixture types and applications. Use of backing strips and backing bars
25. GTAW process; brief description. Difference between AC and DC welding, equipments, polarities and applications. Various other names of the process (TIG, Argonarc). 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. Argon/Helium gas properties –uses. GTAW Defects causes and remedy.

26. Friction welding process; equipment and application. Laser beam welding (LBW) and Electron beam welding (EBW)
27. Plasma Arc Welding (PAW) and cutting (PAC) process – equipments and principles of operation. Types of Plasma arc, advantages and applications.
28. Resistance welding process types, principles, power sources and welding parameters. Applications and limitations.
29. Metalizing –types of Metalizing principles equipments, advantages and applications. ; Manual Oxy – acetylene powder coating process; principles of operation and applications.
30. Welding codes and standards. Reading of assembly drawing. Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR)
31. Hard facing/ surfacing necessity, surface preparation, various hard facing alloys and advantages of hard facing.
32. **Workshop Science and Calculation :**
 - Introduction to Iron and Steel. Differences in Iron & steel.
 - Introduction to Property and uses of C.I. and wrought Iron. , Iron and steel properties and uses.
 - Properties and uses of plain carbon steel and alloy steel.
 - Properties and uses of non ferrous metals and alloys Fraction and decimal - conversion fraction decimal and vice-versa.
 - Properties and uses of copper, zinc, lead, tin, aluminum.
 - Composition, properties and uses of brass, bronze, solder, bearing material, timber, rubber etc.
 - System of units, British, metric and SI units for length, area, volume capacity, weight, time, angle, their conversions. , Effect of alloying elements in the properties of C.I. & steel.
 - Unit of temperature for & related problems. Standard & absolute temp.
 - Mass, volume, density, weight, sp. Gravity & specific weight. S.I. M.K.S. and F.P.S. units of force, weight etc. their conversion to related problems.
 - Inertia, rest and motion, velocity and acceleration.
 - Types of forces, its units and Weight calculation.
 - Revision & Test , Power and roots Factor, Power base exponents number. Multiplication and division of power and root of a number. Square root of number and problems.
 - Heat & temperature, thermometric scales, their conversions.
 - Work energy and power, their units and applied problems.
 - Percentage, changing percentage to decimal and fraction and vice versa. Applied problems.
 - Problem on percentage related to trade.
 - Different types of loads, stress, strain, modulus of elasticity. Ultimate strength, different types of stress, factor of safety, examples.
 - Ratio & proportion- Ratio, finding forms ratio proportions, direct proportion and indirect proportion. Application of ratio and proportion & related problems.
33. **Engineering Drawing :**
 - Engineering Drawing - introduction to Engg. Drawing and its importance.
 - Use of drawing instruments –Drawing of straight, inclined and curved lines.
 - Exercise on linear and angular measurements.
 - Types of lines their meaning & application as per BIS SP: 46-2003.

- Simple conventional symbols for material and parts as per BIS SP: 46-2003. , Geometrical construction of rectangles, square, circles.
- Geometrical construction of polygon and ellipse, parabola & hyperbola.
- Geometrical construction of involutes, oval, and helix.
- Free hand sketching of straight lines, rectangles, circles, square, polygons, ellipse.
- Standard printing style for letters and numbers as per BIS : SP: 46-2003 using stencils
- Free hand sketching of simple geometrical solids, cube, cone, prism, cylinder, sphere, pyramids.
- Scales- Types & its use.
- Revision & Test, Construction of diagonal scale.
- Simple dimensioning technique, size and location, dimensions of parts, holes angles, taper, screw etc. as per BIS SP: 46-2003.
- Transferring measurements for linear, angular, circular dimensions form the given object to the related free hand sketches using different measuring instruments.
- Pictorial drawings, isometric drawings of simple geometrical solids.
- Oblique/orthographic projection of simple geometrical solids.
- Orthographic drawings: Application of both the first angle and third angle. Isometric drawing of simple machined & casting blocks.
- Free hand sketches of trade related hand tools and measuring tools

Note: The above syllabus is indicative and the questions in the test may include similar other topics pertaining to the level and content of essential qualification.