

SYLLABUS FOR DEMONSTRATOR IN WELDING (DIPLOMA)

PAPER-I

BASIC ENGINEERING SCIENCE:

Heat and temperature units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, Expansion of solids, liquids and gases due to heat, co-efficient of expansion. Electricity and its various effects. Electric current-positive and negative terminals, use of switches and fuses. Types of current- AC, DC, Units of current, resistance and voltage; Simple electric circuit-Ohm's law-simple calculation. Conductor, insulator, Types of connections – series, parallel, electric power, Horse power, energy, unit of electrical energy. Concept of earthing.

OCCUPATIONAL SAFETY AND HEALTH EDUCATION:

Safety & Health- Introduction to Occupational Safety and Health importance of safety and health at workplace. **Occupational Hazards-** Basic Hazards, Chemical Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. **Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.** **Accident & safety-** Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.

ENVIRONMENTAL SCIENCE: Basic understanding of social political and natural environment, Comply environment regulation and housekeeping. Environmental pollution, avoidance of instances of environmental pollution. Environmental protection legislation & regulations. Opportunities to use energy and materials in an environmentally friendly manner. Waste and its disposal procedure. Recognize different components of 5S and apply the same in the working environment.

ENGINEERING MECHANICS:

Mass, Weight and Density: Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals. Centre of gravity and its practical application.

Forces definition: - Stress, strain and modules of elasticity, ultimate, strength, factor of safety and different types of stresses, Definition and example of compressive, tensile, shear forces, axial and tangential forces.

Elementary principle of triangle of forces and parallelogram of forces. Resolution and composition of forces. Moment of a force-couples simple problems. Example in simply supported and loaded beams- General conditions of equilibrium for a series of forces acting on a body. Stable, non-stable and neutral equilibrium of bodies-simple explanation.

Work, Power and Energy: work, unit of work, power, unit of power, Horse power, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.

Friction – Limiting friction – measuring of friction – examples. Simple problems on straight and bell crank levers. Laws of friction, co-efficient of friction and angle of friction. Problems on inclined plane.

MATERIAL SCIENCE:

Properties of Material: Properties Physical & Mechanical, Types –Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous Alloys.

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 alloysteels. 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. Aluminium and its alloys, properties and weldability, Welding methods - Arc cutting & gouging, Cast iron and its properties types - Welding methods of cast iron.

PAPER-II

OAW and SMAW Practices: Introduction and definition of welding. Arc and Gas Welding Equipment, 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. 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 over-head position. Weld slope and rotation. Arc length – types – effects of arc length. - Polarity: Types and applications. - Manual Oxy – acetylene powder coating process- principles of operation and applications

Welding Design, Symbols and Safety: Welding Safety: Safety precautions in Gas Metal Arc Welding and Gas Tungsten Arc welding. Welding symbols as per BIS & AWS, Welding codes and standards - Reading of assembly drawing - Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR)

GTAW and GMAW Practices: 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 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. Edge preparation of various thicknesses of metals for GMAW. 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, advantages and limitations. - Thermit welding process- types, principles, equipment, Thermit mixture types and applications. - Use of backing strips and backing bars - GTAW process - brief description. Difference between AC & DC welding, equipment, 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 and principles of operation. - Types of Plasma arc, advantages and applications.

Engineering Drawing:

Drawing of Solid figures (Cube, Cuboids, Cone and Frustum of Cone) with dimensions.

Symbolic Representation (as per BIS SP:46 2003) of : - Fastener (Rivets, Bolts and Nuts) - Bars and profile sections - Weld brazed and soldered joints. Electrical and electronics element - Piping joints and fittings

Simple curves of interpretation-simple exercises. - Development of surfaces of prism, cylinders, pyramids and cones. Fabricated channels simple roof trusses, purlins, braced columns glazing or window frames and welded girders. Fabricated jobs like brackets, bed plates.

Weld Defects, NDT and Welding Joint Analysis: Types of Inspection methods - Classification of destructive and NDT methods - Welding economics and Cost estimation. GMAW defects, causes and remedies. GTAW Defects causes and remedy. - Weld quality inspection, common welding mistakes and appearance of good and defective welds - Weld gauges & its uses metalizing – types of metalizing principles, equipment, advantages and applications. Analysis of weld joints for different static loading conditions, analysis of butt and fillet welds joints. Welding residual stresses and distortions.