DETAILED SYLLABUS FOR THE POST OF JUNIOR INSTRUCTOR - LABORATORY ASSISTANT (CHEMICAL PLANT) IN INDUSTRIAL TRAINING DEPARTMENT

CAT NO: 648/2023

MODULE 1 (10 MARKS)

Fire & Safety in Chemical Lab/Plant, First Aid, Introduction of pollution control (2), General & Physical Chemistry: Introduction to chemistry, Elements, atoms & molecules. Structure of atoms, Chemical & physical changes. Concept about acid, base & salts, Determination of concentration of solutions by Normality & Molarity, IMP by weight by grams per liter, Atomic molecular and equivalent weights (2). Crystallography Solutions, The laws of chemical combinations, Chemical equilibrium, Chemical bonding electronic theory of valency (2), Periodic table of the elements. Periodic study of S & P Block Elements: Periodic study of Zero group and Transition Elements of 3-12 groups, 14th group, 15th group, 16^{th} group, 17th group and 18th group elements (2). Gas laws, Boyle's law, Charl's law, Gas equation, Graham's Law of diffusion, Dalton's law of partial pressure (2).

MODULE 2 (10 MARKS)

Thermo-chemistry & thermodynamics (2). Metallurgy of: Aluminum, Copper, Silver, Chromium, Iron & Steel. Zinc & its alloys (2), Non-Metals: Preparation, properties & uses of Hydrogen & its peroxide, Oxygen, Sulphur& its compounds, Nitrogen & its compounds, Phosphorus & its compounds, Chlorine &Fluorine and its compounds (2), Law of mass action, Le-Chatelier's principle and application in chemical industry. Percentage of elements in chemical compounds. Empirical formulae of chemical compounds. Balancing of chemical equations (2), Radio chemistry, Radioactivity, Decay of radio isotopes, Equation of decay half time value (2).

MODULE 3 (10 MARKS)

Moment and Levers: moments, units, arm of couple and moment of couple, types of levers. Simple machines, efforts and load, mechanical advantage, velocity ratio, efficiency of machines, their relationship, examples (2), Elasticity, Introduction, stress and strain, modulus of elasticity, different types of stresses, Hook's Law, Young's modulus, Yield point, ultimate, stress-strain graph, modulus of Rigidity, Poisson's ratio, bulk modulus, factor of safety, examples (2), Heat and Temperature ;Heat, unit of heat, temperature, difference between heat and temp, modes of heat transfer (2), boiling point, melting point, scale of temp., specific

heat, thermal capacity, water equivalent of heat, interchanges of heat, latent heat of fusion, latent heat of vapour (2), transmission of heat, thermal expansion of solids, liquids and gases, coefficient of linear expansion, indicated thermal efficiency, brake thermal efficiency, examples (2).

MODULE 4 (10 MARKS)

Electricity: Electric current, +Ve and -Ve terminals use of fuses and switches, conductors and insulators (2), Simple electrical Circuits. Ohm's law, electrical insulating Materials (2), Kirchhoff's law, examples, Parallel and series circuit connections (2), Whetstone's bridge potentiometer, conservation of electrical energy into heat energy, Joule's law, Mechanical equivalent of heat (2), Electrolysis, Electro chemistry, electro-chemical series, Heat effect of electricity (2).

MODULE 5 (10 MARKS)

Units of pressure and vacuum; various types of pressure and vacuum gauges, manometers; principles of operation of various pressure measuring instruments and devices; Calibration of gauges (2), Temperature scales, Relationship between various temperature scales; fixed points. Various types of thermometers, thermocouples and pyrometers; Working principles of various temperature measuring instruments; different methods of temperature measurement (2), Various types of Recorders, strip chart, circular chart; principles of operation of various recording instruments and their operations (2), Various types of Controllers On-off, P, PI, PD, PID principles of operation of various controlling instruments and their operations (2), Various types of Transmitters and transducers PI, IP; principles of operation of various Transmitters and transducers (2)

MODULE 6 (10 MARKS)

Introduction to Organic Chemistry. Purification of Organic Compounds. Types of organic reactions, Classification & nomenclature, Aliphatic hydrocarbons (2), Halogen derivatives of hydrocarbons, aliphatic alcohol, Ethers, Aldehydes, Ketones, Carboxylic acid (2), Amides & Anhydride, Acid Halides, Esters, Soaps & Detergents. Amines Cyanogen compounds (2), Carbohydrates & Protein, Polymers, Aromatic Hydrocarbons, aromatic ethers (2), halogen derivatives Compounds with nitrogen, urea, Aromatic acids Compounds of double & triple rings, Heterocyclic compounds Diazonium salts, Color and dyes (2).

MODULE 7 (10 MARKS)

Water Chemistry; Water & its type, Water Treatment, Use of water in various industrial application , Steam generation, Principles of water analysis (2), Meaning of the terms Hardness; Turbidity TDS, TSS, pH, DO, BOD, COD Available Chlorine, Principles adopted in determination of hardness of raw water; Analysis of Boiler feed water, Boiler Blow down Water. (2), Principles of Analysis of Sewage water, Determination of COD, BOD, TDS, Turbidity and potable water for Municipal use, Principles of Chlorine estimation (2), Atmosphere air, Study of physical properties of substances. Study of Rault's Law for dilute solution (2), Fertilizer its types & uses, Examples, compositions; Meaning of the term NPK, Principles of Analysis of Fertilizers, Material balance (2).

MODULE 8 (10 MARKS)

Alloys, Amalgams Definition, examples of Alloys used in industries; Principles of Analysis of Alloys to determine compositions (2), Drugs/Drug intermediates Definitions, Examples. Principles of Analysis Drugs/Drug intermediates (2), Preservatives, Definition, Use, Examples of common preservatives, Principles of Analysis of Preservatives (2), Lipids, Definition, Meaning of the terms Oils, Fats, Acid Value, Saponification value, Iodine value (2), Rancidity Principles of Analysis of Lipids; Hydrogenated fat/Vanaspati Definition, Principles of checking adulteration of Ghee (2).

MODULE 9 (10 MARKS)

Introduction to Microbiology, Introduction to Bacteria cell, Sterilization - Details study (2), pH meaning , scale, different methods of finding pH, Working Principles of PH-meter, Lovibond comparator. Working Principles of Visual Colorimeter (2). Micro- organisms & infections. Streptomycin, Introduction to Industrial Microbiology, Yeast, Bread, Alcohol, Beers, Wines (2), Microbiology techniques, Applications, Examples of Gram positive & Gram negative microbes, Methods of media preparation & incubation, Introduction to Nutrition of bacteria (2), Meaning of Disinfectant, Antiseptic, Reidel-Walker Coefficient, Working Principles of Microscope (2)

MODULE 10 (10 MARKS)

Flue gas. Definitions, Examples, Standard Composition, Principles of Analysis of Flue gas, Solutions used in Orsat's apparatus, Working principles (2), Spectrophotometer; Application, Examples, Features & specification of Spectrophotometer, Precautions to be

observed (2), Fuel (Definition, classification, properties, composition & uses), Examples of Solid Fuels, compositions (2), Meaning of the terms Moisture, VCM, Ash, FC, CV, Principles of Analysis of coal, Working principles of Bomb Calorimeter (2), Working Principles of Particle size Analyzer Features & specification of Particle size Analyzer Precautions to be observed, Tyler series, Relationship between Particle size & Surface area. Working, Principle and Uses of analyzing equipment (2)

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.