No.A.32016/3/2007-I&WR
GOVERNMENT OF MIZORAM
IRRIGATION & WATER RESOURCES DEPARTMENT
Mizoram Secretariat, MINECO, Building No.2, Basement-I, Room No. 2902
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NOTIFICATION

Dated Aizawl, the 20th December, 2024.

In the interest of public service and as mentioned under para 12 (3) (Appendix-IV) of the Mizoram Direct Recruitment (Conduct of Examination) Guidelines, 2018 issued vide No.A.12026/1/2017-P&AR(GSW) dated 9.02.2018 and published in the Official Gazette vide No.69 dated 15.02.2018, the Competent Authority is pleased to notify **Syllabus for Paper-III(Technical Paper)** for direct recruitment to the post of **Sectional Assistant under** Irrigation & Water Resources Department.

Sd/- Er. LALRINKIMA HNAMTE
Secretary to the Govt. of Mizoram,
Irrigation & Water Resources Department.

Memo.No.32016/3/2007-I&WR : **Dated Aizawl, the 20th December, 2024.**

Copy to:-

1. P.S. to the Hon'ble Minister, Irrigation & Water Resources Department.
2. The Chief Engineer, Irrigation & Water Resources Department.
3. Website Manager, Office of the Chief Engineer, Irrigation & Water Resources Department, with a request to upload on the Department's website.
4. Guard File No 17.

(R.LALDINPUII)
Under Secretary to the Govt. of Mizoram,
Irrigation & Water Resources Department.

SYLLABUS FOR PAPER – III (Technical Paper)

FOR DIRECT RECRUITMENT TO SECTIONAL ASSISTANT

UNDER IRRIGATON & WATER RESOURCES DEPARTMENT.

OBJECTIVE TYPE (MCQ)

MARK DISTRIBUTION

Section-A : PHYSICS (70 marks)

Measurement in Science and Technology : Measurements and measurement systems; The international system of units (SI); Need for measurement; Units of measurement, systems of units, Fundamental and derived units, length, mass and time measurement. Errors in measurement, significant figures. Dimensions of Physical quantities. Dimensional analysis and application

Motion in a Straight Line: Frame of reference; Motion in a straight line, Elementary concepts of differentiation and integration for describing motion, uniform and non- uniform motion, and instantaneous velocity, uniformly accelerated motion, velocity time and position-time graphs. Relations for uniformly accelerated motion (graphical treatment).

Motion in a Plane: Scalar and vector quantities; position and displacement vectors, general vectors and their notations; equality of vectors, multiplication of vectors by a real number, addition and subtraction of vectors, Unit vector, resolution of a vector in a plane, rectangular components. Scalar and Vector product of vectors. Motion in a plane, cases of uniform velocity and uniform acceleration- projectile motion, uniform circular motion.

Laws of Motion: Intuitive concept of force, Inertia, Newton's first law of motion; momentum and Newton's second law of motion; impulse; Newton's third law of motion. Law of conservation of linear momentum and its applications. Equilibrium of concurrent forces, Static and kinetic friction, laws of friction, rolling friction, lubrication. Dynamics of uniform circular motion: Centripetal force, examples of circular motion (vehicle on a level circular road, vehicle on a banked road).

Gravitation: Universal law of gravitation, Motion of particles under gravity, Motion of a projectile Gravitational constant, Acceleration due to gravity and its variation with altitude, latitude and depth of earth, Mass of the earth, Gravitational potential energy near the surface of earth, gravitational potential, Escape Velocity. Orbital Velocity of a Satellite.

Weightlessness, Motion of Satellites, geostationary satellites, Kepler's laws of planetary motion. Moment of force.

Work, Energy and Power: Work done by a constant force and variable force, kinetic energy. Potential energy, work-energy theorem, power. Potential energy of a spring, conservative and non-conservative forces, conservation of mechanical energy (kinetic and potential energies), collisions, Elastic and inelastic collision in 1 dimension and 2 dimensions. Different forms of Energies in nature.

Thermal Properties of Matter: Heat, temperature, thermal expansion; thermal expansion of solids, liquids and gases, anomalous expansion of water; specific heat capacity: Cp, Cv- calorimetry, change of state latent heat capacity. Heat transfer-conduction, convection and radiation, thermal conductivity.

Kinetic theory of gases: assumptions, concept of pressure, kinetic energy and temperature. r.m.s speed, degree of freedom, law of equipartition of energy (statement only), mean free path and Avegadro's number.

Thermodynamics: Thermal equilibrium and definition of temperature, zeroth law of thermodynamics, heat, work and internal energy. First law of thermodynamics, Second law of thermodynamics: gaseous state of matter, change of condition of gaseous state isothermal, adiabatic, reversible, irreversible, and cyclic processes.

Oscillations and Waves: Simple harmonic motion (SILM) and its equations of motion, phase: oscillations of a loaded spring- restoring force and force constant, energy in SH.M. Kinetic and potential energies, simple pendulum derivation of expression for its time period, Graphical representation of simple harmonic waves characteristic of harmonic waves, Relation between wave velocity, frequency and wave length for a periodic Nature and propagation of sound, speed of sound Range of hearing in humans, Reflection of sound, practical applications of reflected sound, Echoes, Sonar and Application of Ultrasound

Light reflection and refraction: Nature of light, reflection of light by mirrors-by plane mirror, spherical mirrors, new Cartesian sign convention for reflection by spherical mirrors and derivation of mirror formula, magnification; Refraction of light-the refractive Index, refraction through a rectangular glass slab, refraction by spherical lenses, sign convention for spherical lenses Lens formula, power of a lens, total internal reflection, some optical phenomena in nature, dispersion of white light by a glass prism, color of objects-primary colours of light and pigments.

Mechanics of Solids and Fluids: States of matter, inter atomic and inter molecular forces.

a) Solids: Elastic behaviour, stress-strain relationship, Hooke's law, Young's modulus, bulk modulus of rigidity & some practical examples.

b) Fluids: Pressure due to fluid column, Pascal's law and its application (hydraulic lift and brakes) Effect of gravity on fluid pressure Buoyancy, flotation, and Archimedes principle, Viscosity, Stoke's law, terminal velocity, stream line flow, laminar flow, turbulent flow Reynold's number. Bernoulli's theorem and its applications.

c) Surface energy and surface tension, angle of contact, application of surface tension, excess pressure inside a liquid drop and bubble, rise of liquid in capillary tube (ascent formula).

Electricity, its heating and chemical effects: Electric charges and its properties, conductors and Insulators, electric current-charges in motion; electric potential and potential difference, Ohms law-resistance, resistivity, resistors in series and in parallel; heating effect of electric current-electric energy and electric power.

Magnetic effects of electric current: Magnetic field and field lines; magnetic field around a current carrying straight conductor, force on a current-carrying conductor in a magnetic field, electric motors, electromagnetic induction; electric generators, domestic electric circuits; the electric fuse-A safety device.

Structure of Atom: Fundamental Experiments on discharge tube and the discovery of the electron, Canal rays or positive rays, radioactivity, Atomic nucleus; Structure of atom; Discovery of the neutron, Atomic Number and atomic mass, isotopes, isobars and isotones.

Nuclear Fission and Fusion: Nuclear reactions, Nuclear fission, Fission products; Energy released in fission reactions; Chain reaction. Nuclear fusion, Thermonuclear reaction. Nuclear hazards and safety measures.

The Universe: The solar system the sun, the terrestrial planets, the Jovian planets, asteroids, meteorites and comets. The Structure and evolution of the earth; The stars and constellations; Milky way galaxy and other galaxies: Space Exploration-Space Programme in India

SECTION-B : CHEMISTRY (60 Marks)

Some Basic concepts of chemistry: Nature of matter, properties of matter and their measurements, Law of Chemical combination. Atomic and molecular masses, Mole concept.

Matter Around Us: Physical nature of matter, states of matter: General concept about mixture. solution, colloidal solution, suspension, distillation, condensation, evaporation, sublimation and fusion: Effect of pressure and temperature on states of matter.

Atomic Structure: Cathode ray, X-ray, Thomson's model of an atom, Rutherford's model of atomic structure. Bohr's model of atomic structure, Atomic number, Mass number, Isotopes and Isobars, Radioactivity. Bohr's model of hydrogen and hydrogen like atoms, spectrum of hydrogen, Dual behaviour of matter, de Broglie equation, Heisenberg's uncertainty principle Quantum numbers, shapes of orbital, Aufbau principle, Pauli's exclusion principle.

Classification of Elements: Mendeleev and Modern periodic table, Periodic trend of metallic and non-metallic character, atomic size, nature of bonding, oxides and related chemical properties, prediction of properties of an atom.

Chemical Bonding: Octet rule or inert gas configuration as criteria of stability, lon, atom and valency, lonic bonds, covalent bonds (in simple cases), shape of Molecules of H_2O, NH_3 CH_4 CCl_4 SF_4, PCI_4, CO_2, $BeCl_2$, BF_3.

Chemical reactions and Some basic concepts: Decomposition, Displacement reactions, Isomerization, Combination, Reversible and Irreversible reactions, Chemical equilibrium, Law of chemical equilibrium, chemical formula and equations, Atomic and Molecular masses, Mole concept, gram atomic mass and gram molecular mass, Determination of formula of unknown compounds, Balancing of chemical reactions

Energeties: Bond energy, Energy involved in a reaction. Photo-chemical reactions and generation of free radicals. Electrolysis of water and NaCI, Electrochemical cells (Galvanic cell) with reference to dry cells and storage cells.

Metals: Physical and chemical properties, Reaction with O, dilute acid, Cl_2. Washing soda, Baking soda, lime, preparation of Bleaching Powder, Plaster of Paris, Cement, Glass, Steel. Corrosion of metals

Non-Metals: Physical and chemical properties, reactions with O, acid, Cl, H_2 Preparation and properties of Si, P, S, ammonia, hydrogen and sulphuric acid. Carbon and its compounds: Allotropes of carbon. Hydrocarbon: Alkanes, Isomerism alkanes. Preparation and properties of Methanol, Ethanol, Methanal, Propanone, Synthetic polymers: addition polymers (PVC, Teflon) and condensation polymers (nylons and polyesters): Rubber and its vulcanization; Soaps, detergents, Cleansing action of soaps and detergents.

Organic Chemistry: Classification and nomenclature of organic compounds, Isomerism. Fundamental concepts in organic reaction mechanism, Methods of purification; Qualitative and quantitative analysis of organic compounds

Electrochemistry: Electrolytic conductance, Equivalent and molar conductivities, Galvanic cell, Electrode potential and EMF of a Galvanic cell, Electrochemical cell and free energy, Electrolysis, Some commercial batteries, Corrosion.

Surface Chemistry: Adsorption, Colloidal solutions, Emulsions. Homogeneous and heterogeneous catalysis.

Redox Reactions: Oxidation and reduction as an electron transfer process, Oxidation number balancing of redox equations.

Environmental Pollution: Types of pollution and pollutants, Acid rain, Green House Effect, Eutrophication and Soil erosion. Conservation and protection of environment.

SECTION-C : MATHEMATICS (70 marks)

I. Algebra

Number System: Whole numbers, Integers, Rational and Irrational numbers, Surds and rationalization of surds. Real numbers

Sets: Sets and their representations, finite and infinite sets, subsets, empty or null set, universal set, equal sets, power set and complement of a set, union and intersection of sets and their algebraic properties difference of sets, Venn diagrams, application of sets

Polynomials: Definition of a polynomial, Factorization of polynomials Factorization of quadratic and cubic expressions, HCF and LCM of polynomials.

Rational Expressions: Addition, Multiplication and Division of rational expressions

Linear Equations in one & two variables: Solution of Linear equations in one and two variables by cross multiplication and other simple methods, Application to practical problems.

Complex Numbers: Complex number in the form (a + ib) representation of complex numbers by points in plane, conjugate, square root of a complex number, cube root of unity

Quadratic Equations: Zeros of quadratic equations, Solution of quadratic equations by (i) factorization (ii) method of completion of square, quadratic formula, Application quadratic equations. Arithmetic Progression (AP): Definition, nth term of an A.P., Sum of finite number of terms an A.P.

II. Geometry:

Lines, Angles and Triangles: Geometrical concepts of a point, Angle and a triangle, Angles made by a transversal with two lines, Sum of the angles of a triangle, Different criteria for congruence of two triangles, Properties of Isosceles triangle, Similar triangles, Proportionality theorems,

Concurrent Lines in a triangle. Parallelograms: Definition, Properties of a parallelogram, Types of parallelograms, some theorems on parallelograms..

Circles: Definition, congruence of circles, chords of a circle Arcs of a circle, Angles subtended by Arcs and chords at a point on a circle, angles in a cyclic quadrilateral, Tangents to a circle, Properties of tangents to a circle, Chord of a circle intersecting in a point, Alternate segments and its angles, Common tangents to circles.

Trigonometry: Trigonometric ratios of angles of measures 0% 30°, 45°, 60°,90° Trigonometric ratios of some specific angles, solution of right triangles, Trigonometric ratios of complementary angles, Simple problems on heights and distances, Angles of elevation and depressions, Trigonometric functions of sum and difference of numbers, conditional identities for the angles of a triangle, Solution of trigonometric equations, solution of triangles, concept of inverse trigonometric functions and their use to reduce expression to simplest form.

Mensuration: Area of a triangle, quadrilateral, Circle, sector and segment of a circle, Trapezium, Concept of perimeter of these figures. Lateral and total surface area of right triangular prisms, volume of a tight triangular prism. Lateral surface area and volume of a right pyramid, surface Area and volume of a tetrahedron, Lateral and total surface area and volume of a cuboid, cube, right circular cylinder, right circular cone hemisphere and surface area and volume of a sphere, surface area and volumes of combinations of these solids, volume and surface are of a frustum of a right circle cone

Statistics and Probability: Mean, Median Mode and their properties, Probability as a measure of uncertainty: Random experiment and associated sample space events as subsets of sample space, occurrence of an event, impossible events, sure events, combination of events through the operations "and", "or", "not" and their set representation, Conditional probability, independent- events, independent experiments, Calculation of probability of events associated with the independent experiments P (A or B),

P (A and B), Baye's theorem and its application, mean and variance of random variables, Binomial and Poisson's distributions, their mean, variance and application of these distributions in commerce and industry.

Coordinate Geometry (2D): Distance between two points, section formula between two points. Trigonometric functions of sum and difference of numbers, Trigonometric functions of multiples and submultiples of numbers, conditional identities for the angles of a triangle, Solution of trigonometric equations, solution of triangles.

Calculus: Function, Limits and Continuity: Concept of real function, its domain and range, types of functions, limit of a function, continuity of a function (i) at a point (u) over an open/closed intervals, Sum, product and quotient of continuous functions, continuity of special functions-polynomial, trigonometric, exponential, logarithmic, inverse trigonometric functions.

Differentiation: Derivative of a function, its geometrical and physical significance, Relationship between continuity and differentiability, derivative of sum, difference, product and quotient of functions, derivative of polynomial, trigonometric, exponential, logarithmic, chain rule and differentiation by substitution, Derivatives of second order.