



PUBLIC SERVICE COMMISSION, WEST BENGAL
161A, S.P. MUKHERJEE ROAD, KOLKATA – 700026

Recruitment to the post of Foreman / Apprenticeship Supervisor in the Directorate of Industrial Training, W.B. under the Technical Education, Training & Skill Development Department, Govt. of West Bengal (Advertisement No. - 2/2024).

Scheme:

- Type of Examination: Objective Type Test(MCQ) in 4(Four) different series viz.**A,B,C,D**.
 - No of Questions : 50 Questions; Each carrying 2 marks.
 - Full Marks : 100.
 - Duration : 2 Hours.
- N.B.:** 1) There will be negative marking for each wrong answer. $\frac{1}{4}^{\text{th}}$ of the marks i.e. **0.50** will be deducted for each wrong answer.
2) Extra weightage for possessing desirable qualification will be considered at the Interview Board.

Syllabus:

- Applied Physics:** Syllabus in details placed below - 13 questions.
- Engineering Mathematics:** Syllabus in details placed below - 13 questions.
- Applied Chemistry:** Syllabus in details placed below - 13 questions.
- English [Basic Grammar]:** Parts of Speech, Tenses, Change of Narration, Voice Change, Transformation of Sentence, Synonyms & Antonyms, Group Verbs, Idioms - 11 questions.

The Syllabus is indicative only. Candidates should be prepared to answer any question from essential qualification / Degree mentioned in the advertisement for the relevant post.

By Order of the Commission
Assistant Secretary

Syllabus on Applied Physics

Physical world, Units and Measurements

Physical quantities; fundamental and derived, Units and systems of units (CGS and SI units), Dimensions and dimensional formulae of physical quantities, Principle of homogeneity of dimensions, Dimensional equations and their applications (conversion from one system of units to other, checking of dimensional equations and derivation of simple equations), Limitations of dimensional analysis.

Measurements: Need, measuring instruments, least count, types of Measurement (direct, indirect), Errors in Measurements (systematic and random), absolute error, relative error, error propagation, error estimation and significant figures.

Force and Motion

Force, Momentum, Conservation of linear momentum, its applications such as recoil of gun, numerical problems rockets (concept only), Impulse and impulsive force.

Circular motion, definition of angular displacement, angular velocity, angular acceleration, frequency, time period, relation between linear and angular velocity, linear acceleration and angular acceleration (related numerical), concept of Centripetal and centrifugal forces with examples (No derivation, only formula) banking of roads and bending of cyclist, concept and formula and numerical problems.

Work, Power and Energy

Work: Concept and units, examples of zero work, positive and negative work

Friction: concept, types, laws of limiting friction, coefficient of friction, reducing friction and its engineering applications, Work done in moving an object on rough inclined plane.

Energy and its units, kinetic energy and potential energy, Conservation of mechanical energy for freely falling bodies (simple numerical problems), transformation of energy (examples only).

Power and its units, power and work relationship, calculation of power (numerical problems).

Rotational Motion

Translational and rotational motion with examples, Definition of torque and angular momentum and their relation, Conservation of angular momentum (quantitative) and its applications.

Moment of inertia and its physical significance, radius of gyration for rigid body, Theorems of parallel and perpendicular axes (statements only), Moment of inertia of rod, disc, ring and sphere (hollow and solid); (Formulae only). Simple numerical problems.

Properties of Matter

Elasticity: definition of stress and strain, moduli of elasticity, Hooke's law, significance of stress-strain curve. Surface tension: Concept, units, cohesive and adhesive forces, angle of contact, Capillary rise (formula only), applications of surface tension, effect of temperature and impurity on surface tension.

Viscosity and coefficient of viscosity: terminal velocity, Stoke's law and effect of temperature on viscosity.

Hydrodynamics: Fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem (only formula and numericals) and its applications (mention name only).

Heat and Thermometry

Concept of heat and temperature, basic concepts of measurements of heat and temperature, modes of heats transfer (conduction, convection and radiation with examples), Co-efficient of thermal conductivity simple numerical problems.

Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions of solids and relation amongst them, specific heats C_p & C_v of a gas and their relationship (Mention only).

Syllabus on Engineering Mathematics

Algebra

1. Logarithm:

- Definition of natural and common logarithm
- General Properties of logarithm and simple problems

2. Complex Numbers:

- Definition of Complex numbers, Real and Imaginary parts of a complex number, Equality of two complex numbers, Conjugate of a complex number
- Modulus and Argument of a complex number and simple problems
- Polar and Cartesian forms of a complex number and their relation
- Algebraic operations (Addition, Subtraction, Multiplication, Division) of complex numbers
- De Moivre's Theorem (without proof) and simple problems
- Cube roots of unity and their properties with problems

3. Quadratic Equations:

- Definition of Quadratic Equations
- Finding the roots of a quadratic equation, conjugate roots & simple problems
- Nature of the roots using discriminant & problems
- Relation between roots and co-efficients & problems
- Formation of quadratic equations if roots are given

4. Binomial Theorem:

- Definition of factorial of a number, permutation (${}^n P_r$) & combination (${}^n C_r$) with formula only
- Binomial Theorem (without proof) for any index, simple problems on positive index only
- General Term and Middle Term and problems
- Expansion of $(1+x)^{-1}$, $(1-x)^{-1}$, where $|x| < 1$, exponential & logarithmic series only (no problem)

Vector Algebra

- Definition of vector and types of vectors
- Concept of a position vector and Ratio formula & simple problems
- Rectangular resolution of a vector
- Equality, addition, subtraction of vectors and multiplication of a vector by a scalar
- Scalar (dot) and Vector (cross) product of two vectors with properties & simple problems
- Application of dot product – work done by a force, projection of a vector upon another
- Application of cross product – finding area of a triangle and parallelogram, moment of a force

Trigonometry

- Concept of trigonometrical angles, measurement of angles in degree, radian and grade & their relation only
- Trigonometrical ratios of angles, associated angles, Trigonometric ratios of some standard angles problems
- Compound angles formula (without proof), multiple, sub-multiple angles & simple problems
- Solutions of Trigonometrical Equations, simple problems (angle lies between 0 and 2π)
- Inverse Circular Function & simple problems
- Properties of triangle, basic formulae only

Function, Limit & Continuity, Derivative

1. Function

- Definition of variables & constants
- Definition of function with examples, domain and range of a function
- Types of functions (even-odd, increasing-decreasing, inverse, periodic) with simple examples
- Graph of trigonometric functions, $\sin x$, $\cos x$, $\tan x$ only

2. Limit & Continuity

- Definition of limit (with left hand limit & right hand limit), Fundamental Theorem on limit (only statement), standard limits and simple problems
- Continuity of functions, elementary test for continuity of functions (finite limit)

3. Derivative

- Definition of derivatives
- Derivatives of standard functions
- Rules of differentiation of sum, difference, product and quotient of functions.
- Derivatives of composite functions (Chain Rule)
- Derivatives of inverse circular functions, implicit functions and logarithmic differentiation
- Derivative of parametric functions, derivative of a function with respect to another function
- Second order derivatives with simple problems
- Application of derivatives – Physical & Geometrical interpretation of derivative, checking increasing-decreasing functions, finding velocity & acceleration, Maxima-Minima of function of single variable with simple problems.

Syllabus on Applied Chemistry

Atomic Structure, Chemical Bonding and Solutions

Rutherford model of atom, Bohr's theory (expression of energy and radius to be omitted), and hydrogen spectrum explanation based on Bohr's model of atom, Heisenberg uncertainty principle, Quantum numbers - orbital concept. Shapes of s, p and d orbitals. Pauli's exclusion principle, Hund's rule of maximum multiplicity Aufbau rule, electronic configuration.

Type of chemical bonding: ionic, covalent, metallic and hydrogen bonds. Example of each type. Hybridization, sp^3 , sp^2 , sp , example: $BeCl_2$, BF_3 , CH_4 , NH_3 , H_2O ; structure of diamond, graphite. Solution - idea of solute, solvent and solution, methods to express the concentration of solution-molarity (M = mole per liter), ppm, mass percentage, volume percentage and mole fraction.

Water

Graphical presentation of water distribution on Earth (pie or bar diagram). Classification of soft and hard water based on soap test, salts causing water hardness, unit of hardness and simple numerical on water hardness.

Cause of poor lathering of soap in hard water, problems caused by the use of hard water in boiler (scale and sludge, foaming and priming, corrosion etc), and quantitative measurement of water hardness by EDTA method, total dissolved solids (TDS) alkalinity estimation.

1) Water softening techniques - soda lime process, zeolite process and ion exchange process.

2) Municipal water treatment (in brief only) - sedimentation, coagulation, filtration, sterilization.

Water for human consumption for drinking and cooking purposes from any water sources and enlist Indian standard specification of drinking water (collect data and understand standards).

Engineering Materials

Natural occurrence of metals - minerals, ores of iron, aluminium and copper, gangue (matrix), flux, slag, metallurgy - brief account of general principles of metallurgy. Extraction of iron from haematite ore using blast furnace, aluminium from bauxite along with reactions, reactions during copper extraction. Alloys – definition, purposes of alloying, ferrous alloys and non-ferrous with suitable examples, properties and applications.

General chemical composition, composition based applications (elementary idea only details omitted):

Portland cement and hardening, Glasses Refractory and Composite materials.

Polymers - monomer, homo and co polymers, degree of polymerization, simple reactions involved in preparation and their application of thermoplastics and thermosetting plastics (using PVC, PS, PTFE, nylon - 6, nylon - 66, Bakelite only), rubber and vulcanization of rubber.

Chemistry of Fuels and Lubricants

Definition of fuel and combustion of fuel, classification of fuels, calorific values (HCV and LCV), calculation of HCV and LCV using Dulong's formula.

Proximate analysis and ultimate analysis of coal solid fuel

Petrol and diesel - fuel rating (octane and cetane numbers), Chemical composition, calorific values and applications of LPG, CNG, water gas, coal gas, producer gas and biogas.

Lubrication - function and characteristic properties of good lubricant, classification with examples, lubrication mechanism - hydrodynamic and boundary lubrication, physical properties (viscosity and

viscosity index, oiliness, flash and fire point, cloud and pour point only) and chemical properties (coke number, total acid number saponification value) of lubricants.

Electro Chemistry

Electronic concept of oxidation, reduction and redox reactions.

Definition of terms: electrolytes, non-electrolytes with suitable examples, Faradays laws of electrolysis and simple numerical problems.

Elementary concept of pH and buffer.

Industrial Application of Electrolysis –

- Electrometallurgy
- Electroplating
- Electrolytic refining.

Application of redox reactions in electrochemical cells –

- Primary cells - dry cell,
- Secondary cell - commercially used lead storage battery, fuel and Solar cells.

Introduction to Corrosion of metals –

- definition, types of corrosion (chemical and electrochemical), H₂ liberation and O₂ absorption mechanism of electrochemical corrosion, factors affecting rate of corrosion.

Internal corrosion preventive measures –

- Purification, alloying and heat treatment and
- External corrosion preventive measures: a) metal (anodic, cathodic) coatings, b) organic inhibitors.