GEOPHYSICS (GP)

There will be **Three Sections** in the Geophysics (GP)test paper, namely, Geology, Mathematics and Physics, each with a weightage of 50%. A candidate has to attempt any **Two Sections**.

The syllabi for the Geology, Mathematics and Physics Sections of the Geophysics (GP) test paper are given below:

GEOLOGY SECTION

The Planet Earth: Origin of the Solar System and the Earth; Geosphere and the composition of the earth; Shape and size of the Earth; Earth-moon system; Formation of continents and oceans; dating the rocks and age of the Earth; Energy in the earth system; Volcanism and volcanic landforms; Interior of earth; Earthquakes. Earthâ€™s magnetism and gravity, Elements of plate tectonics.

Geomorphology: Weathering and erosion; transportation and deposition due to wind, ice, river, sea, and resulting landforms, structurally controlled landforms.

Structural Geology: Concept of stratum; Contour; Outcrop patterns; Maps and cross sections; Dip and strike; classification and origin of folds, faults, joints, foliation and lineation, unconformities; shear zones.

Mineralogy: Symmetry and forms in common crystal classes; physical properties of minerals; Isomorphism and polymorphism, Classification of minerals; Structure of silicates; Mineralogy of common rock-forming minerals; Mode of occurrence of minerals in rock. Transmitted polarised light microscopy and optical properties of uniaxial and biaxial minerals.

Palaeontology: Major steps in the evolution of life forms; Fossils; their mode of preservation and utility; Morphological characters, major evolutionary trends and ages of important groups of animals - Brachiopoda, Mollusca, Trilobita, Graptolitoidea, Anthozoa, Echinodermata;

Stratigraphy: Principles of Stratigraphy, Geological Time Scale and ages of major stratigraphic units of India.

Petrology: Definition and classification of rocks; Igneous rock-forms of igneous bodies; Crystallisation from magma; classification, association and

genesis of igneous rocks; Sedimentary rocks-classification, texture and structure; Metamorphic rocks-Classification, facies, texture and structure.

Economic Geology: Physical properties of common ore minerals, General processes of formation of mineral deposits; Mode of occurrence of important metallic and nonmetallic deposits in India; Coal, petroleum and ground water occurrences in India.

MATHEMATICS SECTION

Sequences, Series and Differential Calculus: Sequences of real numbers, Convergent sequences and series. Mean Value Theorem, Taylorâ€™s theorem, Maxima and Minima, functions of several variables.

Integral Calculus: Fundamental theorem of calculus, Integration, Double and Triple integrals, change of order of integration, Surface Areas and Volumes.

Differential Equations: Linear and Non-linear ODE, existence and uniqueness (without proof), Linear Differential Equations of second order with constant coefficients.

Vector Calculus: Gradient, Divergence, Curl, Laplacian, Greenâ€™s, Stokes and Gauss theorems and their Applications.

Linear Algebra: System of Linear Equations, Matrices, Rank, Determinant, Inverse, eigenvalues and eigenvectros. Dimension, Linear transformations.

Probability: Probability spaces, Conditional Probability, Independence, Bayes Theorem, Univariate and Bivariate Random Variables, Moment Generating and Characteristic Functions, Binomial, Poisson and Normal distributions.

Statistics: Sampling Distributions of Sample Mean and Variance, Exact Sampling Distribution (Normal Population), Simple and Composite hypothesis, Best critical region of a Test, Neyman-Pearson theorem, Likelihood Ratio Testing and its Application to Normal population, comparison of normal populations, large sample theory of test of hypothesis, approximate test on the parameter of a binomial population, comparison of two binomial populations.

Numerical Analysis: Difference table, symbolic operators, differences of a factorial, representation of a polynomial by factorials. Forward, backward and central difference approximation formulae. Simpsonâ€™s one-third rule

Newton- Raphson method for finding the solution of f(x)=0.

PHYSICS SECTION

Mechanics and General Properties of Matter: Newtonâ€™s laws of motion and applications, Keplerâ€™s laws, Gravitational Law and field, Conservative and non-conservative forces. System of particles, Centre of mass (CM), equation of motion of the CM, conservation of linear and angular momentum, conservation of energy. Elastic and inelastic collisions. Rigid body motion, fixed axis rotations, rotation and translation, moments of Inertia and products of Inertia. Principal moments and axes. Elasticity, Hookeâ€™s law and elastic constants of isotropic solid, stress energy. Kinematics of moving fluids, equation of continuity, Eulerâ€™s equation, Bernoulliâ€™s theorem, viscous fluids, surface tension and surface energy, capillarity.

Oscillations, Waves and Optics: Differential equation for simple harmonic oscillator and its general solution. Superposition of two or more simple harmonic oscillators. Lissajous figures. Damped and forced oscillators, resonance. Wave equation, travelling and standing waves in one-dimension. Energy density and energy transmission in waves. Group velocity and phase velocity. Sound waves in media. Doppler Effect. Fermatâ€™s Principle. General theory of image formation. Thick lens, thin lens and lens combinations. Interference of light, optical path retardation. Fraunhofer diffraction. Rayleigh criterion and resolving power. Diffraction gratings. Polarization: linear, circular and elliptic polarization. Double refraction and optical rotation.

Electricity and Magnetism: Coulombâ€™s law, Gaussâ€™s law. Concept of Potential, Field and Boundary Conditions, Solution of Laplaceâ€™s equation for simple cases. Conductors, capacitors, dielectrics, dielectric polarization, volume and surface charges, electrostatic energy. Magnetic susceptibility, bar magnet, Earthâ€™s magnetic field and its elements. Biot-Savart law, Ampereâ€™s law, Lenzâ€™s law, Faradayâ€™s law of electromagnetic induction, self and mutual inductance. Alternating currents. Simple DC and AC circuits with R, L and C components. Displacement current, Maxwellâ€™s equations and plane electromagnetic waves. Lorentz Force and motion of charged particles in electric and magnetic fields.

Kinetic theory, Thermodynamics: Elements of Kinetic theory of gases. Velocity distribution and Equipartition of energy. Specific heat of Mono-, di- and tri-atomic gases. Ideal gas, Van-der-Waals gas and equation of state. Mean free path . Laws of thermodynamics. Zeroeth law and concept of thermal

equilibrium. First law of thermodynamics and its consequences. Isothermal and adiabatic processes. Reversible, irreversible and quasi-static processes. Second law of thermodynamics. Carnot cycle.

Modern Physics: Inertial frames and Galilean invariance. Postulates of special relativity. Lorentz transformations. Length contraction, time dilation. Relativistic velocity addition theorem, mass energy equivalence. Blackbody radiation, photoelectric effect, Bohrâ€™s atomic model, X-rays. Wave-particle duality, Uncertainty principle, Pauli Exclusion Principle, Structure of atomic nucleus, mass and binding energy. Radioactivity and its applications. Laws of radioactive decay and half life, Fission and fusion.

Solid State Physics and Electronics: Crystal structure, Bravais lattices and basis. Miller indices. X-ray diffraction and Braggâ€™s law, Origin of energy bands. Concept of holes. Intrinsic and extrinsic semiconductors. p-n junctions, transistors. Amplifier circuits with transistors.