भारत सरकार GOVERNMENT OF INDIA
अंतरिक्ष विभाग DEPARTMENT OF SPACE
भारतीय अंतरिक्ष अनुसंधान संगठन INDIAN SPACE RESEARCH ORGANISATION
राष्ट्रीय सुदूर संवेदन केंद्र NATIONAL REMOTE SENSING CENTRE
बालानगर, हैदराबाद BALANAGAR, HYDERABAD 500 037

No: NRSC-RMT-1-2025/23

Syllabus for Written Test

Advertisement No	:	NRSC-RMT-1-2025 dated 10.05.2025
Name of the post	:	Scientist/ Engineer 'SC'
Post Code	:	**23**
Specialization	:	**Geophysics**
Essential Qualification	:	M.Sc / M.Sc Tech in Geophysics or equivalent With B.Sc in Physics / Maths / Geology
Number of Posts	:	03

The syllabus for the above posts is given below. Candidates may note that it is not exhaustive but indicative only. Refer above advertisement for pattern of the examination.

Part-A: Area/ Discipline Specific part (90 Minutes, 80 Marks, 80 Multiple Choice Questions)

Geology:
Basic principles of Geology, origin of the earth, weathering of rocks, development of land-forms by deposition and erosion processes (valleys, mountain building processes, volcanoes, alluvial fans, meanders, oxbow lake, lagoon, flood plain etc.), plate tectonics, earth quakes. Basics of petrology of rocks including igneous, sedimentary and metamorphic type of rocks; rock forming minerals, basic physical and optical properties of minerals, mode of formation of major minerals (Bauxite, Iron ore, Talc, and Copper etc.) formation. Structural Geology: covering primary and secondary structures, folds, faults, joints, unconformities. Economic geology: Ore genesis, syngeneic and epigenetic ore deposits, hydrothermal deposits, sedimentary deposits. Petroleum Geology: Chemical composition and physical properties of petroleum crude, origin of petroleum, migration of oil and gas, gas hydrates etc. Reservoir rocks-classification, source, reservoir and trap rocks etc., Petroliferous basins of India.

Physics of the Earth:
The Earth as a planet in the solar system (obliquity, rotation, equinoxes, solstices, etc.); figure of the Earth; basics of various Geospheres, Atmosphere, Ionosphere, Asthenosphere, lithosphere-hydrosphere and Biosphere. Gravity field and its variations on the surface of the Earth, Geoid, spheroid and Ellipsoid of the earth, shape and size of the earth. Geomagnetic field, Magnetic elements and description of the magnetic fieldorigin and reversals of the magnetic field and Paleomagnetism including natural and remnant magnetisation. Heat sources in the Earth, Geothermal flux distribution over continents and oceans; Geochronology: Rock dating methods, U-Th, K-Ar, Rb-Sr, C-14.Different physical and Engineering properties of rocks, laboratory measurements of the physical properties of rocks namely Density, Seismic wave velocities, magnetic susceptibility, Electrical resistivity, thermal conductivity, porosity and permeability. Natural and artificial seismology, causes and propagation of different seismic wave, principle and instrumentation of seismographs, various methods for determination of focal depth and epicentral location. Concepts of Geodynamics.

Seismic exploration:
Refraction and Reflection Methods, Propagation of Seismic Waves in Linear and Nonlinear medium. Waveforms and their characteristics and Elastic wave velocities in rocks. Explosive and Non Explosive sources Seismic operations, Wiggle Trace, Common Depth Point technique, 2D, 3D and 4D Seismics.

Sequence of Digital Seismic data Processing, Seismic data reduction, Static and dynamic corrections Analysis of Multiples and Ghost Reflections, Time and Depth Sections, Seismic Inversion, Migration Techniques, Wave Equation Migration, Time and Depth Migration, Determination of Average Seismic Velocities, and Synthetic Seismograms. Tomography Processing and interpretation of Refraction Seismic data – Methods based on first and later arrivals, Hidden layer. Application of Seismic methods in Hydrocarbon, Mining, Groundwater, Lithologic Modelling and Engineering studies.

Magnetic method:
Magnetic field of the Earth and its variation in space and time. Concept of Magnetic potential and field Poission's relation. Magnetic elements. Factors contributing to the main Magnetic fields of the earth. Magnetic properties of rocks and minerals –Para–dia & ferromagnetism. Natural Remnant magnetization. Working principles of modern Magnetometers(Fluxgate, Proton Pression & Rubidium vapour), Magnetic survey procedures on land, marine and air borne, IGRF. Satellite magnetic data. Scales of Surveys, Accuracy, Corrections to magnetic data. Regional-Residual separation using different methods, derivatives and Continuation techniques, calculation of second derivatives, reduction to pole. Concepts of forward modelling and indirect interpretation. Magnetic anomaly expressions over simple magnetic bodies. Structure calculation and Spectral analysis for depth estimation, Ambiguity in magnetic interpretations.

Gravity methods:
The gravitational field of the earth and its variation in space and time. Concept of gravity potential, Poisson's and Laplace equations, International Gravity Formula, Factors contributing to the variation of gravity on the surface of the earth. Basic principles of gravimeters. Gravity survey procedures on land, at sea and in satellite gravity. Determination of surface rock densities using Netelton and other empirical methods. Various corrections(Free air, Bouguer, Terrain etc), Regional – Residual separation using graphical and averaging methods, least squares methods, Green's Equivalent layer etc., and gravity anomalies over common geological features. Continuation techniques, calculation of second vertical gradients. Gravity anomaly expressions over simple geometric models. Concepts of 2D, 2.5D and 3D models. Computation of anomalies over irregular bodies. Spectral methods in quantitative interpretation – limitation. Ambiguity in gravity interpretations. Application of gravity methods in various fields.

Electromagnetic and Electrical methods:
Principles of electromagnetic Prospecting, description of elliptic polarization, relation between the major and minor axis of ellipse of polarization with real and imaginary components of secondary field. EM wave propagation, skin depth. EM methods using artificial sources and natural field. Principles of the equipment, field procedure, quantitative Interpretation of anomalies for plate shape bodies. Effect of over burden and ore bearing rocks on the response of local conductor. Electrical properties of rocks and minerals, description of the potential and electrical field due to simple source of current (monopole, dipole and linear sources).Basics of Resistivity methods of prospecting, concepts of true and apparent resistivities. Two electrode, Three electrode Dipole, Schlumberger, Wenner arrays and their Geometric factors, Principle of reciprocity. Electrical profiling and Vertical Electrical Sounding (VES), apparent resistivity over a layered earth, master curves for Schlumberger arrays, two, three and multiplayer VES curves. Concept of spontaneous polarization, field procedures, uses in ore bodies identification. Typical responses over sphere and rod like bodies. Induced polarization (IP) technique, sources of IP, membrane and electrode polarizations, Time domain and Frequency domain measurement of IP, chargeability, percent frequency effect and metal factors, apparent chargeability over layered earth. Field Procedure.

Geophysical Inversion:
Basic concepts of forward and inverse problems, Ill-posedness of inverse problems, condition number, non-uniqueness and stability of solutions; L1, L2 and Lp norms, overdetermined, underdetermined and mixed determined inverse problems, quasi-linear and nonlinear methods including Tikhonov's regularization method, Singular Value Decomposition, Backus-Gilbert method, simulated annealing, genetic algorithms, swarm intelligence, machine learning and artificial neural networks. Statistics of misfit and likelihood, Bayesian construction of posterior probabilities, sparsity promoting L1 optimization. Ambiguity and uncertainty in geophysical interpretation.

Thermodynamics:
Quantum theory of radiation: Black body-Ferry's black body, distribution of energy in the spectrum of Black body, Wein's displacement law, Rayleigh-Jean's law, quantum theory of radiation, Planck's law, deduction of Wein's distribution law, Rayleigh-Jeans law, Stefan's law from Planck's law. Measurement of radiation, determination of solar constant, and effective temperature of Sun. Basics of thermodynamics: Kelvin's and Claussius statements, Entropy and its physical significance.

Optics:
Principle of superposition, coherence, change of phase on reflection, Interferometer, determination of wavelength of monochromatic light, Diffraction fundamentals, Fresnel and Fraunhoffer diffraction, Polarization fundamentals, Polarization by reflection, refraction, Double refraction, selective absorption, scattering of light.

Electromagnetic waves:
Maxwell's equations in vacuum and dielectric medium, boundary conditions, plane wave equation, velocity of light in vacuum and in medium, polarization, reflection and transmission. Polarization of EM waves, description of linear, circular and elliptical polarization.

Modern Physics:
Black body Radiation, Photoelectric effect, Compton effect, dual nature of radiation, wave nature of particles.

Elementary Number Theory:
Primes and Composite numbers; Fundamental Theorem of Arithmetic; Divisibility; Congruence; Fermat's theorem; Wilson's Theorem; Euler's Phi Function

Linear Algebra:
Vector Spaces, Subspaces; Linear dependence and independence of vectors; basis and dimension; Quotient spaces; Inner product spaces; Orthonormal basis; Gram Schmidt process. Linear Transformations; Rank and nullity; Change of bases; Matrix of a Linear Transformation; Singular and Non-singular matrices; Inverse of a matrix; Eigenvalues and Eigenvectors of a matrix and of a Linear Transformation; Cayley Hamilton's theorem; Quadratic forms; Signature and Index

Ordinary and Partial Differential Equations:
Ordinary Differential Equations (ODE) of First order and First degree; Different methods of solving them; Exact Differential equations and Integrating factors; ODE of First order and Higher degree; Clairaut's equations; Singular Solutions; Linear Differential Equations with Constant Coefficients and Variable Coefficients; Variation of Parameters. Formation of Partial Differential Equations (PDE), Solving first order and second order PDEs; General Solution of Higher Order PDEs with Constant Coefficients

Vector Calculus:
Vector and scalar, gradient, divergence, curl, Line Integrals, surface integrals and volume integrals, Gauss's divergence theorems, Green's theorem and the Stokes theorem.

Part-B: Aptitude/Ability tests (30 Minutes, 20 Marks, Maximum of 15 Multiple Choice Questions)

Topics: Numerical Reasoning; Logical Reasoning; Diagrammatic Reasoning; Abstract Reasoning; Deductive Reasoning