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-1-2025/21

Syllabus for Written Test

Advertisement No	:	NRSC-RMT-1-2025 dated 10.05.2025
Name of the post	:	Scientist/ Engineer 'SC'
Post Code	:	**21**
Specialization	:	**Geoinformatics**
Essential Qualification	:	M.Sc in Geoinformatics or equivalent With B.Sc in Physics/ Maths
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)

Remote Sensing:

Basic concepts and definitions of remote sensing; Laws of Radiation; Electromagnetic (EM) spectrum : Source and Interaction with matter and atmosphere; Atmospheric windows; Remote sensing data platforms, Satellite orbits, Types and characteristics of different remote sensing platforms – sun synchronous and geosynchronous satellites, Satellites for earth observation (Indian and international missions) and planetary studies; Sensors and Characteristics of optical, thermal and microwave Sensors; Resolutions – Spectral, Spatial, Temporal and Radiometric; Remote sensing data errors and image quality; Visual and digital interpretation methods; Image interpretation keys; Remote Sensing Data Products, output medium.

Optical Remote Sensing: EM Interaction with natural targets in optical and short wave infrared regions, scattering mechanism, fundamentals of spectroscopy, spectral indices, Spectral signature

Thermal Remote Sensing: Basic principles and laws; Space-based thermal imaging systems; Thermal properties and Diurnal temperature of common materials; Emissivity, Characteristics and interpretation of thermal images; Land surface temperature estimation; Major applications of thermal remote sensing.

Microwave Remote Sensing: Principles of Active and Passive microwave remote sensing systems; Radar equation; factors governing radar return; Dielectric Properties, Surface Roughness and Interpretation, Speckle and its Reduction; Characteristics and interpretation of SAR imagery; Principles of SAR interferometry, Differential SAR interferometry and SAR Polarimetry; Major applications with SAR.

Hyperspectral Remote Sensing: Basic principles, Sensors and data characteristics, platforms, spectral filtering, Data pre-processing, atmospheric correction, noise reduction, End member extraction, Classification methods, major applications with hyperspectral data.

LiDAR Remote Sensing: Principles of LiDAR remote sensing; Types of LiDAR, Components of a LiDAR system, LiDAR platforms; 3D point cloud, Basics of LiDAR data processing and applications.

Global Navigation Satellite System (GNSS):

Principle and Components of GNSS; Concepts of rapid, static, semi-kinematic, pure kinematic and RTK methods; Global/Regional Satellite constellations, GNSS signals; Pseudo Range measurement; Data collection methods; Errors in observations and corrections; GNSS receiver types and positioning concepts; Augmentation Systems (SBAS, GBAS), PNT interoperability; GNSS Applications.

Geographical Information system (GIS):

Definition; GIS components; Functions of GIS; important GIS softwares; Data Sources; Raster & Vector Data Models, Data Structures; Geographical data formats; Attribute types; Creation of Databases, Spatial data input techniques and devices used; vectorization and structuring map data; spatial and non-spatial data models; Concepts of Topology, topological relationships; Sources of data errors; Positional accuracy, Temporal accuracy, Thematic accuracy and Data Lineage, Metadata; Algorithms for spatial data generation and analysis; Map Composition; Spatial modelling; Principles, elements, architecture, services and applications of Web GIS; Concept of Mobile GIS; multi-criteria analysis and Spatial Decision Support System (SDSS); Data Mining; 3D-GIS; Location based services; Cloud GIS; Geospatial Big Data Analytics; Data cube and their applications; Geospatial standards; Open source GIS; Geoportals.

Surveying and Mapping:

Basic characteristics of map; Cartographic representation of geographic objects; Scales and uses; Symbolization; map accuracies; Map data distortions; Coordinate systems; map projections, Map datum.

Land Surveying: Chain traversing, Plane table, Various Levels, Leveling methods, Compass, Theodolite and Total Station and their uses, Tachometer, Trigonometric leveling, Traversing, Triangulation and Trilateration.

Photogrammetry:

Definition; Types of aerial photographs; Flying height and scale; fundamentals of stereoscopy; Tilt and relief displacements, Orthophoto/ Orthoimage; Satellite-based stereo sensors and their characteristics; Stereo plotting instruments; Basic principles of analytical and digital photogrammetry; Photo interpretation, Coordinate transformation, satellite photogrammetry and applications; Principles and applications of close range photogrammetry; Digital Elevation Model (DEM) and related terminologies (DSM, DTM, nDSM); Sources of DEM; DEM derivatives and their applications.

Digital Image Processing and classification:

Digital image characteristics and their statistical characteristics; Variance-Covariance matrix, Correlation matrix and their significance; Radiometric and Geometric Corrections; Ground Control Points, Co-registration and Resampling techniques, Interpolation methods; Digital Number (DN) to Top of Atmosphere (ToA) reflectance conversion; Basics and methods of atmospheric correction; Radiometric normalisation; Image Enhancement : spectral and Spatial enhancement methods; Image Transformations; Fourier Transformation, Principal Component Analysis, Spectral indices; Band Ratioing and normalization, Image Segmentation; Unsupervised and Supervised classification techniques / algorithms; estimation of Classification accuracy.

Advanced spatial filtering techniques in spatial and frequency domain; Image texture; Image fusion methods and applications; Change detection and its applications; Advanced classification techniques– Object-based, Fuzzy, Machine learning algorithms.

Computers and Computing Techniques:

Fundamentals of computers, software, operating systems, basics of computer programming, Database Management Systems (DBMS), Relational DBMS (RDBMS), Structured Query Language (SQL), Entity Relationship Model, Unified Modeling Language, Web technologies, Open Geospatial Consortium (OGC) Standards.

Geospatial Applications:

Thematic map preparation; Major applications in Agriculture, Soils, Water resources, Land use land cover, Forestry, Geosciences, Urban & regional studies, Watershed management, Disaster management, Infrastructure planning and Environmental studies, Ocean and Coastal Applications.

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.

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