



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-1-2024/16

Syllabus for Written Test

Advertisement No	:	NRSC-RMT-1-2024 dated 22.01.2024
Name of the post	:	Scientist/ Engineer 'SC'
Post Code	:	16
Specialization	:	Water Resources
Essential Qualification	:	M.E / M.Tech in Remote Sensing and GIS/ Geo informatics or equivalent With B.E/ B.Tech in Civil Engineering / Agriculture Engineering
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 (75 Minutes, 60 Marks, 60 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, 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.

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; Characteristics and interpretation of thermal images; Land surface temperature estimation; Major applications of thermal 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, spectral filtering, Data pre-processing, 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; Basics of LiDAR data processing and applications.

Global Navigation Satellite System (GNSS):

Principle and Components of GNSS; 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; Algorithms for spatial data generation and analysis; 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: 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; Orthophoto/ Orthoimage; Satellite-based stereo sensors and their characteristics; Stereo plotting instruments; Basic principles of analytical and digital photogrammetry; 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; Co-registration and Resampling techniques, 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; Spectral indices; 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), web technologies.

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.

Mathematics:

Linear Algebra & Matrix algebra; Probability and Statistics: Sampling theorems; Descriptive statistics Distributions; Regression methods; Numerical Methods: Error analysis. Numerical solutions; numerical differentiation.

Hydrology & Water Resources:

Surface Hydrology: Hydrologic cycle, Hydrographs, Evapotranspiration, Soil-Water-Infiltration, Rainfall-Runoff, Routing, Ground water Hydrology

Irrigation:

Irrigation concepts, methods, crop & irrigation requirement, soil water balance, Irrigation efficiencies, Irrigation structures, soil salinity/alkalinity

Dams & Reservoirs:

Types of Dams/Weirs, Reservoir site selection, Reservoirs Sedimentation, Catchment area treatment

Fluid Mechanics:

Properties of fluids, Continuity, momentum and energy equations and their applications, Flow in pipes, pipe networks; Concept of boundary layer and its growth;

Hydraulics:

Open channel flow & concepts, Measurement of discharge

Soil & Water Conservation:

Soil Types & Properties, Infiltration, Water conservation methods, Ground water development, soil erosion & control, hydraulic structures

Environmental Engineering:

Water and Waste Water Quality parameters - Water and Waste Water Treatment

Surveying:

Principles of surveying; coordinate system; Leveling and trigonometric leveling; Traversing and triangulation survey

Remote Sensing and GIS:

Concepts of remote sensing, Photogrammetry, Remote Sensing sensors; Digital image Processing; Geographic Information System; Microwave/Hyperspectral/Thermal remote sensing; Global Positioning System (GPS); Remote sensing and GIS applications.

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.

Part-C: Descriptive questions (30 Minutes, 20 Marks)

Technical questions from topics as given under Part-A relevant to the '**specialization**' mentioned in the advertisement.