



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-1-2024/07

Syllabus for Written Test

Advertisement No	:	NRSC-RMT-1-2024 dated 22.01.2024
Name of the post	:	Scientist/ Engineer 'SC'
Post Code	:	07
Specialization	:	Forestry & Ecology
Essential Qualification	:	M.Sc in Botany / Forestry or equivalent With B.Sc in Botany / Forestry / Ecology
Number of Posts	:	04

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)

Molecules and their interaction relevant to biology:

Structure of atoms, molecules and chemical bonds; Composition, structure and function of biomolecules; Stabilizing interactions; Principles of biophysical chemistry; Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes; Metabolism of carbohydrates, lipids, amino acids nucleotides and vitamins.

Cellular organization and genetics:

Membrane structure and function; Structural organization and function of intracellular organelles Organization of genes and chromosomes; Cell cycle and cell division. Principles of Mendelian inheritance, linkage, recombination, genetic mapping; extra chromosomal inheritance; Introduction to epigenetics; gene silencing/ transgene silencing, post transcriptional gene silencing, miRNA and siRNA; evolution and organization of eukaryotic genome structure, gene expression, gene mutation and repair, chromosomal aberrations, transposons. Model organisms for functional genetics and genomics;

Principles & methods of taxonomy:

Concepts of species and hierarchical taxa, biological nomenclature, classical & quantitative methods of taxonomy of plants, animals and microorganisms, history of plant taxonomy, diversity and classification of plants, APG system of plant classification; phylogenetics and cladistics, molecular taxonomy and DNA barcoding; Centres for plant taxonomy and herbaria in India.

Plant anatomy:

Anatomy of root, stem and leaves, floral organs, embryo and young seedlings, Primary and secondary meristems, stellar organization, vascular system and their ontogeny, xylem and phloem structure, secondary growth in plants and wood anatomy, plant cell structure and differences from animal cells.

Plant physiology:

Photosynthesis; CO₂ fixation-C₃, C₄ and CAM pathways. Respiration and photorespiration; Nitrogen metabolism; Plant hormones; Sensory photobiology; Solute transport and photoassimilate translocation; Secondary metabolites; Stress physiology

Plant breeding, genetic modification, genome editing:

Principles, methods – selection, hybridization, heterosis; male sterility, genetic maps and molecular markers, embryo rescue, haploid and doubled haploids, plant tissue culture: micropropagation, embryo culture and in vitro regeneration, somatic embryogenesis, artificial seed, cryopreservation, somaclonal variation, somatic cell hybridization, marker-assisted selection, gene transfer methods viz. direct and vector-mediated, generation of transgenic plants; Introduction to genome editing: CRISPR/Cas9, Cre-Lox system to generate chimeras; plastid transformation; chemical mutagenesis.

Ecosystems ecology:

Abiotic and biotic components; scales; niches and habitats Ecosystems – types, dynamics, degradation, biogeochemical cycles, ecological succession; food webs and energy flow through ecosystem; vegetation types of the world, Indian vegetation types and biogeographical zones, climate and flora endemism; pollution and global climate change, speciation and extinction, biodiversity and conservation strategies, ecological hotspots, afforestation, habitat restoration; plant interactions with other organisms; epiphytes, parasites and endophytes;

Ecosystems structure and function:

Trophic levels and their interactions; nutrient cycles; primary and secondary productivity Ecological Succession: Types; mechanisms; changes involved in succession; concept of climax. Ecosystem structure; ecosystem function; energy flow and mineral cycling (C,N,P); primary production and decomposition

Environmental Sciences:

Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere. Laws of thermodynamics; Meteorological parameters - pressure, temperature, precipitation, humidity, mixing ratio, saturation mixing ratio, radiation and wind velocity, adiabatic lapse rate, environmental lapse rate; Sustainable development. Natural resources and their assessment.

Population and Community Ecology:

Population growth rates; metapopulation ecology; age-structured populations; Interactions; ecophysiology; prey-predator interactions; community ecology; species richness, evenness and diversity indices, species-area relationships; theory of island biogeography; Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India. Conservation Biology

Methods in biology:

Mathematics and statistics in ecology: Simple functions ; concept of derivatives and slope of a function; permutations and combinations; basic probability; frequency distributions ; descriptive statistics, Statistical hypothesis testing: Concept of p-value; Type I and Type II error, test statistics like t-test and Chi-square test; basics of linear regression and ANOVA.

Methods of estimating population density of animals and plants, ranging patterns through direct, indirect and remote observations, sampling methods in the study of behaviour, habitat characterization: ground and remote sensing methods.

Remote Sensing and GIS : Electromagnetic Radiation, Electromagnetic Spectrum, effects of atmosphere – absorption, scattering, reflection; Radiation laws, Sensing radiant energy, Earth Observation Satellites and their characteristics; Geographic Information ; Applications of remote sensing techniques and GIS in forest resources assessment: forest type mapping, forest canopy density mapping, change analysis

Forestry mensurations and biometry:

Forest mensurations. Scales and units of measurement, Methods, principles - ocular, instrumental, non-instrumental measurement of tree diameter and girth, crown width; Height measurement, Tree stem form - Metzger's theory, form factors, quotient height, taper table, volume measurement of felled trees, calculation of log volume, volume estimation of standing trees, Measurement of age: Measurement of forest crop - diameter, height, age and volume, calculation of current annual increment and mean annual increment of stand, yield tables, mathematical models; Stand structure–even aged and uneven aged, management of sample plots Forest inventory–planning and design, alternatives, sampling, execution, compilation and reporting; Site quality estimation: Tree height as a measure of site quality, site index curves, Direct and indirect methods of site quality evaluation; Basic concepts of biomass estimation, simple indices of biomass, actual biomass estimation.

Applied Ecology & Evolution:

Biodiversity and conservation: Importance of conserving biodiversity; ecosystem services; threats to biodiversity; invasive species; in-situ and ex-situ conservation; conservation genetics; DNA fingerprinting and DNA barcoding

Applied Ecology: Environmental pollution; global environmental change; biodiversity status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches; Global climate change: Causes, consequences, mitigation.

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