Syllabus for Written Examination for the post of Assistant Scientist/ Sr. Scientific Assistant

Maximum Marks: 100   Duration: One Hour

Part A: Remote Sensing, GIS and GPS (Compulsory for all candidates)   75 Marks

i.   Remote sensing

Physics of Remote Sensing - Energy Sources, EMR Spectrum and its properties, Radiation Principles (Plank's Law, Stephen Boltezman law, Wien's displacement law, Kirchoffs Law), Energy Interaction with Atmosphere, Energy interaction with earth surface features.Reflectance characteristics of Earths cover types.

Remote Sensing Systems: Remote Sensing Platforms, Space and orbits, Keppler's law of motion, Orbiting Mechanisms of Satellites, Photographic and Non-photographic Sensors, Active and Passive Remote Sensing, across track and along track sensors, Optical sensors, Panchromatic, Multi-spectral, Hyper-Spectral imaging, Resolutions: Spectral, Spatial, Radiometric and Temporal.

 Data Acquisition –Satellite data products and types. Radiometric and geometric errors and their correction, Earth Resources Satellites: Sensors with technical specifications of IRS, Resourcesat and Cartosat satellite series, Landsat, SPOT, IKNOS, Quick-bird, World View, Modis, Radarsat and NoAA satellites.

Image Interpretation: Generation of B/W, True colour and False Colour Composites (FCC), Introduction to image Interpretation, Basic principles of Image Interpretation, Elements of Image Interpretation, Techniques of image Interpretation, Concept of signatures, Visual verses digital Interpretation, Interpretation Keys.

Digital Image Interpretation: Radiometric and spectral enhancement techniques, Contrast stretching: Linear and non-linear methods, Low Pass Filtering: Image smoothing, High Pass Filtering: Edge enhancement and Edge detection, Band ratio, Types of Vegetation indices, Pattern reorganizatio, Subject and Object oriented image classification. Temporal data analysis and change detection, Principle component analysis, Supervised classification and its algorithms (Parallelpiped, Minimum Distance to Mean, Maximum Likelihood), accuracy assessment, Unsupervised classification, Clustering Algorithms, isodata clustering, over all accuracy, kappa coefficient.

ii.   Geographical Information System (GIS)

Basic Concepts of spatial information, map: scale, type and uses, Coordinate System, map projections: type, characteristics and uses, Definition and components of GIS, Features and variables: points, lines, polygon, Spatial and Non-spatial Databases, Advantages of Database, Types of Databases, Data Structures: Raster Structure, Vector Structure, GIS Data Requirement, sources and collection, Methods of data capture: scanning, digitization. Errors in data capture, Conversion from other digital Sources, Attribute data input and management, Edge matching, Metadata standards and formats, Data retrieval and Data compression. Vector & Raster data query, Geographic visualization; Local operations, Zonal operations, Distance measure operations, Spatial auto correlations, DEM generation, Spatial Modeling, Combining data; Terrain mapping, Finding and quantifying relationships; Interpolation: Techniques of interpolation, Topological

Relationships; Creation of Topology. Overlay Operations and Buffering, Neighborhood functions, Distant Measurement, Map Manipulation, Network analyses, Integration of Thematic data in GIS, Geometric Transformations: Map to map, Image to map transformation. Spatial data editing: Types of error, sources of error, locational, digitizing and topological errors and their editing. Combining attributes from overlaid maps. Accuracy, Precision and data quality,

iii. Global Positioning System (GPS):

Introduction of Global Positioning System, GPS signals and data, Geo-positioning-Basic Concepts. NAVSTAR, IRNSS. GPS segments: Control Segment, Space Segments, User Segment. GPS Positioning Types: Absolute Positioning, Differential positioning, Methods: Static & Rapid, Kinematic, Real time kinematic Survey, DGPS, GPS data processing and Accuracy. Selection of Reference Station, Reference Station Equipment: GPS receiver, GPS antenna, GPS Application in Surveying and Mapping, Location Based Services, Vehicle Navigation and Tracking.

Part B. Specialization   **25 Marks**
Candidates have the option to attempt any one of the three sections relevant to their specialization

I. Agriculture, Soils and Land use
Indian agricultural production of major crops, crop enumeration, Physical features and climate of India, weather forecasting, Indian Monsoon, agro-climatic zoning, meteorological disasters (floods, droughts, cyclones etc.), climate change and its impact on agriculture, agro-met services.

Crop growth and productivity, crop growth models describing yield, growth factors related to biomass - concept of growth rates- canopy photosynthesis, canopy architecture, light interception as a major function of leaf area index (LAI), Carbon-fixation, estimation of biomass and net primary productivity (NPP), Concept of source and sink, Harvesting Index, Environmental factors determining crop growth, biotic and abiotic stress.

Soil formation, physical and chemical properties of soils, soil survey and mapping, soil survey and mapping, soil classification, soil chemistry, soil fertility and fertilizers, soil nutrients, soil erosion, problem soils and their management, C and N cycles.

General Geography and demography of India and its major natural regions, landforms, drainage, climate, soils and natural vegetation of India, environmental problems, developmental issues and regional planning, types and patterns of rural and urban settlements; processes of urbanisation; morphology and functional classification of towns.

Land use statistics of India and Haryana, classification of land use, wastelands, land degradation, Land evaluation, land suitability and land irrigability classification, land use planning, cropping patterns, crop rotations, major field and horticultural crops of Haryana, major crop disease of Haryana, agronomic practices, major agricultural problems/ issues in India.

OR

II. Forestry, Environment, Ecology
Type of forests in India, Ecological and physiological factors influencing vegetation, natural and artificial regeneration of forests, management of forests and plantations, commercial forests, forest

mensuration, forest cover monitoring, Forest surveying – different methods of surveying, Agro-forestry, Social Forestry.

Definition and scope of ecology, autecology, synecology. population, community, biome, tolerance range and limiting factors. Distinguishing characters of forests, grasslands, arid lands and wetlands; community organization- concept of habitat, functional role and niche, key stone species, dominant species, ecotone, edge effect. Ecosystem, food chain, trophic levels, ecological pyramids. Biodiversity, its levels and mapping. Population dynamics, Ecological succession, climax community, vegetation of India.

Environmental issues of global significance including climate change, stratospheric ozone depletion, biodiversity conservation and environmental episodic events. Natural Hazards: causes, distribution pattern, consequences and mitigation: Earthquake, Tsunami, Volcanoes, Cyclone, Flood, Drought, Landslide, cold and heat hazards, forest fire. Hazard zonation and mapping, Risk Reduction Measures.

Biogeochemical Cycles (C, N), atmospheric constituents, Green house gases, chlorofluoro-carbons and climatic change, Air, Water and soil pollution: Sources and nature of Air, Water and soil pollutants, their control and treatment, Photochemical smog. Solid waste: generation, collection, environmental effects and disposal. carrying capacity, Environment Impact Assessment (EIA): origin and development, EIA in project planning and implementation: EIA process: evaluation of proposed actions, scoping and base line study, identification and prediction of impacts.

OR

III. Water Resources
Water resources scenario in India, hydrological cycle and its significance, hydro-meteorological parameters, occurrence of groundwater, , the relation of groundwater flow to geologic structure, types of aquifers, aquifer properties, Darcy's law, hydrograph analysis, groundwater flow, types of well, well hydraulics, pumping test, well drilling, water harvesting methods, groundwater recharge methods, groundwater flow modelling, groundwater exploration methods, groundwater basin.

Surface and groundwater quality, pollution of surface and groundwater, drinking water and irrigation water standards, water logging and salinity: causes and remedial measures, fresh water-saline water interface, conjunctive use of water, soil aquifer treatment, water erosion, water conservation: technologies and measures, hydogeomorphic units, surface and groundwater scenario of Haryana, groundwater prospects mapping, hydrogeology of Haryana.

Irrigation systems, methods of irrigation, irrigation water efficiency, River basins in India, interlinking of rivers in India, Drainage: surface and subsurface drainage, bio-drainage, groundwater resources estimation, reservoir sedimentation, soil-water-plant relationship, crop water requirement, canal command area mapping and management, transport process in rivers, lakes and reservoirs, flood monitoring, management and flood modelling, drought monitoring and management, watershed management, water harvesting techniques and structures, impact of climate change on water resources, water economics.