NABARD

NATIONAL BANK FOR AGRICULTURE AND RURAL DEVELOPMENT
SYLLABUS FOR THE WRITTEN EXAMINATION FOR THE POST OF
ASSISTANT MANAGER IN GRADE 'A'

GEOINFORMATICS

(The syllabus is illustrative and not exhaustive. The syllabus should not be considered as the only source of information while preparing for the examination. Keeping in view the nature of examination, all matters falling within the realm of the subject concerned will have to be studied by the candidate as questions can be asked on all relevant matters under the subject. Candidates appearing for the examination should also prepare themselves for answering questions that may be asked on the current/latest developments/Acts taking place under the subject(s) although those topics may not have been specifically included in the syllabus.)

Basics of computers - An introduction to computers, development of computers, Hardware and Software.

Fundamentals of computers - Operating systems, Input to the cOmputers, storage devices, central processing unit, computer output, Compact disk cartridges, Floppies, etc.

Personal Computers - Data communication and networks - Application software, word processing, spread sheets, Data management and graphics.

Programming languages - FORTRAN, C++, HTML, JAVA etc., Compilers / assembler, Classification of programming languages.

Data Base Management System, Multimedia, Outlines of UNIX / WiNDOWS.

The Spherical Earth Size and shape - spherical and ellipsoidal earth - the geoid and datum - latitude and longitude, time and distances - sphere to paper maps and projections - coordinate systems and UTM grid systems

Landforms and Processes : Major landforrns and oceans - exogenic and endogenitic earth activities - process of weathering and landforms - agents of erosion and their problems - river processes and landforms - desert processes and landforms

Weather and Climate : Atmosphere and its energy budget - temperature distribution -. winds and general circulation - moisture, humidity and precipitation - climatic types - climatic and natural vegetation.

Soils, plants and animals Soil chemistry and soil types - environment and ecological concepts major flora and fauna - terrestrial and marine eco systems.

Man and Environment Major agricultural types - mineral distribution and man -

man and water management - man and human settlements.

History and Concepts, Advantages of Remote Sensing over conventional aerial photography - Data acquisition and data analysis - Energy sources and radiation principles, Energy interactions in the atmosphere, energy interactions with the earth surface features, Spectral reflectance of vegetation, soil and water.

Basic concepts of visible, infrared, thermal and microwave remote sensing

Microwave sensing, Radar development, Side Looking Radars, Geometric characteristics of SLAR imagery - Earth surface feature characteristics influencing radar returns, image signatures and polarisation

Earth Resource Satellites, early history of space imaging, platforms (ground, aerial and space) and sensors - Indian Remote Sensing Programs: Aryabhata, Bhaskara I and II programs, IRS satellite missions and their capabilities - Overview and scope of the future IRS Missions,

Techniques of interpretation: Aerial photointerpretation, satellite image interpretation, Recognition elements: Tone, Colour, Texture, Pattern, Shape, Size and associated features

Human Settlements SettlementS : patterns - rural settlements and types - urban settlements and types - settlements in association with land form. climate and water resources towns and cities - urban morphology and land use.

Resources and Land Use : Physical resources and economic resources - primary economic activities and patterns - secondary economic activities and patterns - transport and trade - land use components - land use analysis

Culture and Development : Population and demographic regions - developed and developing regions - concept of culture and major cultural regions - language, linguistics and religious regions folks and ethnicity - changing cultural landscape.

Geographic Representation : Maps and mapping - map design - symbolization, conventional signs and map layout - map referencing and indexing - scale of maps and map contents - types of maps - field work techniques - socio - economic survey and attribute data.

Applied Geography : Location, distance and optimization in space - regions, boundaries and regional planning - resource analysis and sustainable development - GIS, infomiation, query and decisions - landform, seasons, production and business opportunities.

Aerial Photography, types of aerial photographs, geometry of aerial photographs, significance of scale and types of mosaic - Stereoscopy, viewing instruments, normal vision, vertical exaggeration and factors affecting vertical exaggeration

Process of aerial photography, basic requirements of aerial photographs, planning for photography, aerial cameras, planning and execution of photographic flights and procurement of aerial photographs.

Airphoto interpretation - photo characteristics, truth, interpretation keys, elementary methods of map making, direct tracing, reflection and projection instruments, radial line triangulation, planimetnc mapping by radial line plotting, Ground control for aerial photogrammetry

Cartography: Cartography today, Nature of Cartography, History of Cartography, Graticules, Cartometry - Earth, Earth-Map relations, Map Projections- Outlines and types, Scale Reference and coordinate system, Transformation - Basic Transformation, Affine Transformation.

Source of data - Ground Survey and Positioning, Remote Sensing data collection, census and sampling, data models for digital cartographic information, map digitising perception and design, Cartographic design, colour theory and models, colour and pattern creation and specification and map compilation.

Basin concepts about Spatial information, Definition, Historical evolution and need for spatially based resource information system, objectives of GIS - Manual vs automated GIS.

Data structure types of data structure, Raster and Vector formats, advantages and disadvantages of various data structures and data formats.

Data input: data pre-processing, methods of data capture, digitisation and scanning methods, commonly used map projections and ellipsoids.

The format of GIS - Handling digital Geographical Information Data - Analysis of single data planes in Raster format - Analysis of Multiple data planes in Raster format - Uses of topographic data in Raster format - Data structures for thematic maps.

Digital Elevation Model (DEM): need, methods, data sources and products of DEM - Digital Terrain Modeling (DTM) - Input verification, storage and methods of data analysis for Spatial modeling - Methods of GIS and Spatial interpolation

Origin of the Earth - Age of the Earth - Interior of the earth - Earthquakes: Definition - Effects - Causes - Volcanoes: Distribution - Causes - Effect of volcanic eruptions - Geological work of Running water and Underground water.

Brief outline of Seas and Oceans.

Structural geology: Topographic maps - Geologic maps - Outcrops and their trends with Reference to slope and topography - Clinometer compass and its uses - Brief Study of Folds - Faults - Unconformities - Joints

Principles of Stratigraphy - Standard stratigraphic scale - Contemporaneity - Homotaxis - Physiographic divisions of India - Brief study of Archaean rocks - Cuddapah - Vindhyans - Gondwanas - Trassic of Spiti - Jurassic of Kutch - Cretaceous succession of Tiruchirappalli and Pondicherry - Bagh beds of Narmada valley - Lameta beds - Deccan traps - Origin - Composition - Distribution - Age - Siwaliks.

Definition of fossil - Nature and modes of preservation of fossils - Uses of fossils -

Brief study of Corals - Echinoids - Crinoids - Pelecypods - Cephalopods - Brachiopods - Trilobites - Graptolites - Gondwana flora of India - An outline of the uses of Micropaleontology.

Physical properties of minerals - Brief study of the following rock forming minerals - Feldspar group - Amphibole group - Pyroxene group - Olivine group - Quartz group - Mica group - Garnet group.

Matrices - Characteristic equation - Eigen values and Eigen vectors of a real matrix-Cayley- Hamilton theorem - Reduction of a real symmetric matrix to diagonal form and reduction of quadratic form to canonical form by orthogonal transformation.

Analytical Geometry (3 dimensions): Distance Division formulae - Direction Cosines and direction ratios, planes - straight line - angle between planes / straight line - shortest distance.Differential Calculus: Determination of nth derivatives of standard functions - Leibnitz's theorem (without proof) and applications.

Partial differentiation - Euler's theorem - Total differentiation, differentiation of composite and implicit functions - Jacobians errors and approximations. Vector differentiation: Velocity, acceleration of a vector point function - Gradient, Curl, Solenoidal, Irrotational fields and their properties.

Applied statistics: review of frequency distribution, Measures of location. dispersion Skewness, Kurtosis, Regression on analysis.

Definition of digital photogrammetric image, Creation of digital Images, automatic measurment of fiducial mark, automated photogrammetric point measurment.

Creation of digital photogrammetric image, automated surface modeling, Digital Photogrammetric workstation.

Basic components of AutoCAD, using them to make simple map designs and on-screen digitisation, Map editing, layer control and layer integration, display devices, look up tables.

Programming: Approach to programming, modular design of programming, structural programming statements, intrinsic functions, character set, coding forms, classification of instructions, program statements, constants, variables, data types, operators, string manipulations and sting handling functions.

Pointers: Pointers and arrays, Pointers and functions, pointers and structures. Dynamic memory allocation and linked list - concept of linked list, basic list operators.

Definition-Rocks, their general classification into igneous, sedimentary and metamorphic - Forms and structures of igneous rocks- Textures - Classification of igneous rocks - An outline of classification of sedimentary rocks -Textures and Structures of sedimentary rocks -Definition - agents and kinds of metamorphism - Zones, grades and facies of metamorphism - Textures and Structures of metamorphic rocks.

Processes of mineral formation - Classification of Mineral deposits - Brief study of

Gold, Iron, Copper, Manganese, Lead & Zinc, Bauxite, Coal and Petroleum

Groundwater in hydrologic cycle - Origin of water - Meteoric - Juvenile - Magmatic and Seawater - Brief description of porosity, specific yield, specific retention and permeability - Types of aquifers: Unconfined - Confined - Perched - Aquifuge - Aquitard - Aquiclude - Groundwater recharge - Articificial recharge - Groundwater movement: Darcy's law - Groundwater basins of Tamil Nadu.

Environmental Geology - Brief account of different energy systems - Short account of renewable and non-renewable resources - Mitigation and Disaster and remedial measures relating to natural hazards - effects of urbanization on quality of surface waters and causes for groundwater pollution - Impacts of man on environment - Types of Pollution.

Role of engineering geology in civil construction and mining industry - Various stages of engineering geological investigation for civil engineering projects - Engineering properties of rocks - Brief study of Geological consideration of Dams and Reservoirs - Tunnels

Image representation and Preliminaries - Image and Digital images: Different types of images and acquistion (like real images, aerial images, etc.), simple image model, sampling and reconstruction - uniform sampling and quantisation - Information on image formats - Graphic representation on theory, RLE, LZW, DCT, BIVIP, TIFF, GIF, PIX, JPEG etc.

Digital Analysis - image rectification and restoration: Radiometric, atmospheric and geometric corrections, correction in the spatial spectrum of the images. image enhacement - Contrast manipulation, Gray-level thresholding, level slicing, and contrast stretching, Spatial feature manipulation - Spatial filtering, edge enhancement and fourier analysis.

Mult-image manipulation - Multispectral band ratio and differencing, principal components, canonical components, vegetation components, and intensity-hue-saturation (HIS) colour space transformation.

Image classification, Supervised classification - the classification stage, minimum distance to mean classifier, parallelepiped classifier, Gaussian maximum likelihood classifier and the training stage.

Unsupervised classification - output stage, graphic products, tabular data, post classification smoothing, Classification Accuracy Assessment, Data merging - multitemporal data merging, change detection procedures, multisensor image merging, merging of image data with ancillary information.

Data collection and Organisation - different types, Data Base management and data coding etc. Networks – networks, local area network, wide area network, servers, hubs, nodes, modems, line plivers, ETPS, Concepts of Hypernet, Wide Area Information on Servers (WAIS) World Wide Web (WWW), Internet, communication satellites, Information on Superhighway, Data access and Data transfer.

Operating Systems: multi user environment, different operating system viz. UNIX, WINDOWS, LINUX etc. concepts of data sharing between users of same group and

security of information from other groups, UNIX commends - Programs to learn branching and looping, arrays, structure and univons, static and automatic variables, strings.

Web systems and applications: the WWW as communication System, developer's tour of Web, Options for Web connections - Web Development Process: Principles and Methodologies, Planning, Analysis, Design, Implementation, Promotion, Innovation. HTML: Basic & Advanced HTML, Distributing Information, Blocks, Tags, Document creation, linking, Handling Images, Graphics navigation, Tables and Math Equations, Style sheets, Netscape extensions.

Web Programming with Java. Writing Java Applet, Order Entry System - Features and Handling events, Entry fields, Lables and Validation, Managing the Applet Layout, Adding Graphics and Logo - Exception Handling and Browser Interaction.

Reading and Writing within Java, Network Programming with Java, General Purpose classes extending Java - Developing Database applications, Multithreading, Multimedia, Game Applets, Security issues.

Scope of Remote sensing in Earth Sciences, Remote Sensing applications in geological investigations.

Remote Sensing applications to lithology - Igneous, Sedimentary and Metamorphic rocks, their physical properties, mode of origin and mode of occurrence - Lithological mapping using aerial photos and satellite imagery.

Remote Sensing and GIS applications to Geomorphology - Geometric agents, Processes and form, Geomorphological features and Classification, Interpretation of Drainage pattern and classification.

Nature and type of land forms, denudational, structural, fluvial, marine, aeoilan. glacial and volcanic land forms, their pattern and configuration.

Remote Sensing and GIS application to Geological investigation - Mineral resources, Groundwater. Petroleum, Engineering Geology and Environ mental Geology.

Basics: Hydrologic cycle, estimation of various components of hydrologic cycle - clouds, rainfall, runoff, evaporation, transpiration, evapotranspiration, interception, depression storage.

Floods and flood management. Spectral properties of water. GIS application in surface water modeling.

Ground water and water quality: Aquifers, Surface water indicators - vegetation, Geology, Soil, aquifer parameters - Water quality mapping and monitoring - Correlation mode for pollution detection.

Irrigation and Watershed management: Project investigation, implementation, maintenance stages, location of storage/diversion work, canal alignment, capacity calibration curve generation, conjunctive use of surface and ground water.

Mapping and monitoring the catchment and command area, water harvesting

structures, sediment yield, modelling, reservoir siltation, GIS application in watershed management.

Simple graphics using lines and ellipse, area filling, animation using get and put programs and multiple files.

Global Positioning System (GPS): Main segments, nature and sources of errors in GPS signals, differential GPS.

GIS and Remote Sensing data integration, Pattern recognition and thematic mapping, GIS and integration of other types of data.

GIS Data base design and organisation: spatial frame work, spatial and non-spatial data, base creation, linking spatial and non-spatial data, updation strategy.

GIS Integrated Analysis - Modelling - Cartographic data capture and storage.

Sensors for environmental monitoring, sensors, visible and outside visible wave length, absorption spectrometers, collecting institution data, need, selection of ground truth sites, sea truth observations.

Remote Sensing techniques for weather forecasting and climatology, emissivity characteristics, measurement of atmospheric temperature, composition, constituent distribution and concentration, wind flows and air circulation. Hurricane tracking, Air pollution and monitoring, meteorological satellite systems.

Importance of water - water quality, water pollution, potential pollution, sources - water run off, decomposition of animals and plant materials, water quality management, now surface cover, flood prediction. Soil and land forms, insects and disease, wind erosion, salinity, flood damage, soil limitation.

General consideration rural structure, urban area, industrial pollution, chemical effluents, land reclamation, solid waste disposal, mining pollution, demography and social changes.

Conservation and resource management - spectral reflectance from vegetated surface, phenological studies, conservation in national parks, resource management, wildlife studies, GIS for monitoring ecosystems.

Basics: Fundamentals of Data Base Management - Fundamentals of Distributed Database System - Computer Networking - Uses of Computer Networks.

Transport Layer - Session Layer - Presentation Layer - Application Layer - Data Transmission in the OSI Model.

Services: OSI Terminology-Connection Oriented and Connection less -Services-Service Primitives - Relationship of Services to Protocols - Example Networks.

Data Base management Software-Back end - ORACLE or equivalent package - Front end - Visual Basic or equivalent package - Case Studies - National Resource Management System

Crops: Agriculture Ecosystems, Yield parameters, spectral properties of crops, identification of crops and acreage estimation, vegetation indices, production forecasting through digital analysis, monitoring and condition assessment - case studies

Soils: Soil survey methods, soil classification, Land evaluation, Saline, alkaline soils, soil mapping using RS data, soil identification and mapping of problem soils, sedimentation and erosion, soil conservation - case studies.

Damage Assessment: Disease detection - pest attack, damages due to droughts and floods, water logging and salinity, soil moisture, land degradation.

Forestry: forest taxonomy, forest density, type mapping using RS techniques inventory of forests, delineation of degraded forests, damage assessment, forest ecosystem management and protection, preservation and recreation.

Integrated Surveys: integrated surveys for sustainable development, watershed approach, agriculture and forest development - GIS for drawing out action plans - case studies and recent development - Agroclimate modeling, watershed planning.

Oceanography: Coastal Processes - Oceanic circulation, Upwelling and sinking, Current measurement, waves, surface waves, Water motion in waves, reflection, diffraction and refraction, wave generated currents - Tides, Tidal forces and sediment drift.

Remote Sensing application for coastal erosion and accretion, salinity intrusion. navigation, estuarine studies and coastal zone management.

Morphology of Sea. Morphological divisions of sea and biological environment - biological productivity of ocean environment, food chain of the sea.

Remote Sensing Applications: Use of Microwave data, ERS, MOS, NIMBUS, OCM, CZCS studied, chlorophyll production index, coastal and ocean resource management.

Wetland mapping, site location for mariculture, sea surface temperature (SST) studies to forecast pelagic fish population, Mangroves, coral reefs and other pollution assessment - case studies.

Importance of Remote Sensing data for Urban Planning and Settlement - Analysis and identification of Settlement features from images - Visual and digital data analysis techniques.

Regional analysis: Suitability of Remote Sensing data, Land use/Land cover/ Landscape mapping, classification system, settlement types - Rural and Urban mapping - Environmental factors suitable and unsuitable for settlement development.

Urban Analysis: Types of data for urban study - Urban morphology, Zoning systems, Urban land use zoning, slums, commercial and residential zones, Urban sprawl - Urban area delineation and change detection - Urban expansion and land suitability/identification for new township using Remote Sensing Data, Rural Land

Analysis.

Use of Aerial Photographs: Urban dwelling, Population Estimation, Urban Renewal and Area Planning, Study of infrastructure and utility areas, Power and Drainage, Transport network analysis, Updating - Traffic/Transport Planning, Route alignment,

Information System: Date Base Organisation - Geographic Information System on a large scale, data entry manipulation, retrieval, suitable software package, use of information for urban planning - case studies.