Geospatial Information Science and Technology

(1) REMOTE SENSING

Definition and terms, concepts, types of aerial photographs, aerial cameras, displacements and their corrections and rectification, Physics of remote sensing, Characteristics of electro-magnetic radiation; Interactions between electro-magnetic radiation atmosphere and earth's surface, Types of remote sensing, Sensor type characteristics: imaging systems, photographic sensors, Characteristics of optical sensors, Sensor resolution, Characteristic of optical detectors; Imaging sensors, Atmospheric errors and removal; Geometric and radiometric distortions. Panchromatic, multispectral and hyperspectral data products. World and Indian Space Programmes.

(2) DIGITAL IMAGE PROCESSING

Image processing system; Satellite data acquisition –Storage and retrieval – Data Formats – Compression – Satellite System – Data products – Image display system – Current Remote Sensing Systems, Preprocessing of remotely sensed data; Radiometric and Geometric distortions and corrections, Spectral Ratioing –Principal and Canonical Components– Vegetative Components, Image Rectification and Restoration, Image enhancement techniques, Pattern recognition, Digital image classification, Change detection procedures- multisensor image merging,

(3) ADVANCED REMOTE SENSING TECHNIQUES

Hyperspectral Imaging: Hyperspectral concepts, data collection systems, calibration techniques, data processing techniques; preprocessing, Classification techniques, airborne and space-borne hyperspectral sensors, applications, High resolution hyperspectral satellite systems. Thermal radiation principles, processes and thermal properties of materials, thermal conductivity, thermal capacity, thermal inertia, thermal diffusivity, emissivity, sensing radiant temperatures, radiant versus kinetic temperatures, blackbody radiation, atmospheric effects, interaction of thermal radiation with terrain elements, IR detection and imaging technology, thermal sensors and scanners, airborne IR surveys, satellite thermal IR images, thermal IR broad band scanner and multispectral scanner, radiometric calibration of thermal scanners, interpretation of thermal IR imagery, temperature mapping with thermal scanner data. Basics of Microwave Remote Sensing, Physics of RADAR waves, spectral characteristics of RADAR waves, microwave radiometers, active and passive microwave sensors. LIDAR Remote Sensing, spectral characteristics of laser, laser interaction with objects, LiDAR data integration with spectral data, and Applications of LiDAR.

(4) GEOGRAPHIC INFORMATION SYSTEM

Basic Concepts and overview of GIS. GIS data: spatial and non-spatial, spatial data model: raster, vector, Topology and topological models; Map projection and co-ordinate system, Georeferencing and datums, Spatial referencing using coordinates and geographic identifiers, metadata; Spatial data acquisition; Attribute data sources; Spatial and attribute data input; Data storage, RDBMS, database operations; Spatial and non-spatial data editing functions; Quality of spatial data; GIS analysis functions: Retrieval, classification, measurement, neighborhood, topographic, interpolation, overlay, buffering, spatial join and query, connectivity, network functions, watershed analysis, view-shed analysis, spatial pattern analysis, spatial autocorrelation, trend surface analysis; GIS presentation functions: data visualization methods, exporting data and 3D-GIS.

Digital surface modeling by DTM/DHM and DSM/DEM, Interpolation techniques, GRID and TIN, break lines, profiles, mass points, / random points, factors influencing choice of sampling patterns, DTM generation process, preprocessing, main processing, post processing, differential rectification, mosaicing, automatic production of digital orthophotos. Differential sampling techniques- manual, semiautomatic, automatic sampling techniques, storage of TIN Grid and its data base structure. Data sources, / input to DTM, Direct and indirect data collection method. Concept of Web GIS, Components of web GIS, Web GIS v/s Internet GIS, Applications of web GIS, users and stake holders of web GIS, advantages and limitations of web GIS.

(5) GLOBAL POSITIONING SYSTEM

Basic concepts of GPS, GPS coordinate systems: WGS-84, GPS time; GPS Errors and biases; GPS orbital Geometry and Navigational solution. Concepts of DGPS, differential corrections, accuracy in DGPS, GIS and GPS integration. Applications of GPS and DGPS.

(6) APPLICATION OF REMOTE SENSING AND GIS : Agriculture, Coastal Management, Disaster Management, Earth Sciences, Environmental Science and Management, Forest Management, Transport Network Analysis, Urban, Rural Development and Regional Planning, Utility Management, and Watershed Management.